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# MINNESOTA MEDICINE

*Journal of the Minnesota State Medical Association*

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APRIL, 1921

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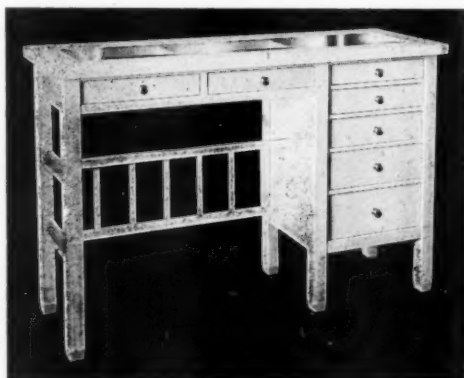
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*Journal of the Minnesota State Medical Association*

VOL. IV

APRIL, 1921

No. 4

## ORIGINAL ARTICLES

### REGIONAL ANESTHESIA IN SURGERY OF THE HEAD\*

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Rochester, Minnesota.

Local infiltration is a well-known procedure consisting in the free and liberal distribution of an anesthetic solution in the subcutaneous tissues, as well as in the deeper layers, and its characteristic feature is that the site of injection lies along the line of incision. Sometimes the skin is first anesthetized and incised, and supplementary injections made in the fascia through the surgical wound. Occasionally this technic has been found objectionable, especially in cases of infected wounds or areas, and there is now a general tendency to replace it by circumferential infiltration; that is, the subcutaneous distribution of the solution along straight lines which are the sides of a geometric figure, one of the diagonals of which is the line of the proposed incision. Injections are also carried deep in planes passing through those sides, so as to erect walls of anesthesia encircling the operative field. This is called "field blocking" and is the first step toward nerve blocking.

The principal reasons for the adoption of field blocking are: (1) absence of distortion of the anatomic features along the line of incision; (2) anemia of the tissues within the blocked area, due to the vasoconstrictive effects of epinephrin contained in the novocain solution; and (3) muscular relaxation with greater facility for the use of contractors. The principal objection to direct local infiltration is the frequent occurrence of defective healing of the surgical wound.

The advantages of regional anesthesia are

most apparent in operations on the head because the anatomy of the head is so peculiar, compared with that of the rest of the body, its sensory nerve supply is so remarkably simple, and its vascular system so decidedly rich; for the same reasons the disadvantages of general anesthesia are here most self-evident.

The sensory innervation of the head is chiefly due to the trigeminus. The cervical nerves supply the scalp backward and laterally as far as the vertex. All the nerves distributed to the frontal, temporal, and occipital regions become subfascial on a line encircling the head, drawn above the ear and passing through the occiput and the glabella. They emerge from the fascia, become subcutaneous, and converge toward the vertex where some of the branches anastomose. It is therefore very easy to insensitize any portion of the scalp by making subcutaneous injections; and this procedure not only anesthetizes the skin, but gives anesthesia to the fascia, periosteum, and bone of the crown of the head. The first branch of the trigeminus is not accessible. The various branches of the ophthalmic nerve may be blocked in the orbit or as they emerge from that cavity. The second branch, or superior maxillary, may be blocked at its exit from the foramen rotundum, either through the orbit or laterally from two sites of puncture, the first, on the lower border of the zygoma through the sigmoid notch of the ascending ramus, and the second, above the zygomatic process of the malar bone. The infra-orbital nerve is reached at the infra-orbital foramen. The third branch or inferior maxillary is injected at the foramen ovale, with a technic similar to that used for the superior maxillary, but instead of passing anteriorly to the pterygoid process into the sphenomaxillary fossa, the needle is advanced posteriorly toward the foramen ovale. The inferior dental and lingual nerves are very easily reached on the medical aspect of the ascending ramus near the dental foramen. The

\*Presented before the staff of the Mayo Clinic and the Faculty and Fellows of The Mayo Foundation, Rochester, Minn., October 12, 1920.

mental nerves are usually blocked at the mental foramen.<sup>1, 2, 3, 4, 5</sup>

Regional anesthesia has its most brilliant applications in the surgery of the head, and the study of nerve blocking at the base of the skull is most attractive. Field blocking is an easy routine procedure in operating on the scalp, cranium, and brain, especially on the vertex; but blocking the branches of the trigeminus for extensive operations on the face requires special training with a hat pin on both skeleton and cadaver. Once the study of the passage of the great nerve trunks through that labyrinth of foramina, canals, and fissures has been mastered, the operative difficulties on the living are overcome with a little patience, care, and method. There are accurate and reliable procedures for reaching the great nerve trunks by deep injections, especially the branches of the fifth nerve at their points of emergence from the various foramina, the study of which carries with it a wealth of information common to physicians and surgeons.

Neuralgias are sometimes relieved by extra-neural novocain infiltrations or by alcohol injections into the nerve trunks, and nearly all operations on the head and within the cranial cavity are within the scope of regional anesthesia.

In dental<sup>6</sup> and ophthalmic surgery nerve blocking is the method of choice.<sup>4</sup> In superficial and minor operations, such as excision of sebaceous cysts, and suture of the scalp, infiltration around the operative field is always successful. The needle is inserted through two or more anesthetic intradermal wheals previously infiltrated with the fine needle, and the solution spread into the soft tissues along the line joining two of the wheals. The different wheals are joined in such a way as to block the operative field at the center of which lies the intended line of incision, or the wound. When extensive lateral sutures of the scalp are proposed, a line of infiltration is drawn just above the zygomatic arch and produced both ways to meet the glabella and the occiput, passing above the superior margin of the orbit and above the ear. In certain cases it is necessary to connect the extremities of this semi-oval by a sagittal infiltration so as to control the nerves overlapping from the opposite side. Along and above the zygoma, deep injec-

tions down to the bone should be made so as to reach the temporal nerves.<sup>2, 7</sup>

If the injections are carried within the superficial fascia and under the epicranium, craniectomies are painless. Malignant growths involving the dura may be extirpated by this same simple method. The dura is insensitive and so is the brain in the usual operative areas. Regional anesthesia thus finds its indications in depressed fractures and for evacuation of epidural or subdural hemorrhage or of intracranial abscesses. Osteoplastic flaps may be raised with a view to operating on the cortex of the brain. Subtemporal decompression may be performed and tumors of the cerebellum successfully dealt with.

The regional method has the advantage of avoiding the edema of the brain which results from the use of general anesthesia. Ether congests the brain and causes considerable bleeding of the diploe, necessitating the use of Horsley's bone wax. The oozing of the very small vessels and the danger of postoperative hemorrhage are factors that need consideration. The epinephrin contained in the novocain solution used in all these cases acts as a hemostatic and it is hardly necessary to clamp any except the larger blood vessels. For operating under regional anesthesia, all bone instruments should be sharp so as to avoid or rather lessen the unpleasant shock as much as possible; undue hammering should be avoided.

All minor and superficial operations on the soft tissues of the face are usually performed with field blocking. If the skin only is to be removed infiltrations are made in the subcutaneous tissue, but attention must be called to the fact that in certain parts of the face where the nerves emerging from their foramina lie in the middle of the operative area, superficial anesthesia can only be obtained by blocking the nerves at their exits, that is, the mental and infra-orbital regions. The lower lip may be anesthetized by blocking the two mental nerves either from outside or through the mouth and carrying the injection beneath the skin and mucous membrane obliquely outward as far as the angle of the mouth. We should not forget that the cervical nerves sometimes overlap the lower border of the lower jaw and that infiltration along that border is often a necessity. For the upper lip, it is preferable to inject both infra-orbital



nerves, and it is sometimes convenient to make a deep injection below the septum of the nose.

Many surgeons abstain from using regional anesthesia for such mutilating operations as the extirpation of the tongue or resection of the maxilla, owing to the severe psychic effect on the unfortunate conscious patient, even the most stoical.<sup>1</sup> The technic of regional anesthesia is suitable, however, for any partial or total resection of the tongue or of the maxilla and if the great difficulty of administering general anesthesia in these cases is taken into account and the fact that the patient is always aspirating blood, it should not be considered a too severe trial for the patient to be conscious of the operation. In certain cases, intratracheal anesthesia may be carried on by some special device, either through the nostrils or tracheal wound, tracheotomy having been performed previously with a view to general anesthesia by long tubing from an ether regulator worked at a distance by some clever anesthetist and controlled by the surgeon; but I would rather convince the patient of the difficulties attending such operations under general anesthesia, give him some scopolamin morphin as preliminary psychic treatment and proceed with regional anesthesia.

In case of partial resection, if the growth is situated at or near the tip of the tongue, a wall of anesthesia involving its entire thickness is raised across the organ at a little distance from the lesion; if the lesion lies on the side of the tongue, the injections should be made in two planes at right angles to each other, one of them being parallel with the long axis of the tongue, thus anesthetizing the quadrant bearing the growth. Total resections may be made by (1) blocking the dental and lingual nerves on the side of the ascending ramus, (2) injecting the cervical plexus, (3) infiltrating the base of the tongue so as to block the glossopharyngeal, and (4) blocking the superior laryngeal. If a cross incision of the cheek from the angle of the mouth is needed, infiltration should be made involving its thickness along a line drawn from the malar bone to the lower jaw at the level of the second molar teeth.

Tonsils are operated on by infiltrating the anterior pillar and the tissue situated laterally and behind from two puncture points towards the poles of the tonsil.

Regional anesthesia in ophthalmology has been greatly developed in the last years, and it is chiefly to Duverger, Professor at Strassbourg, that we owe our clinical knowledge of local anesthesia in ophthalmologic surgery. Cocain in 10 per cent solution gives a good superficial anesthesia, but novocain-epinephrin solutions are the best when deep injections are resorted to. The strength varied from 2 to 5 per cent and the quantities injected depend on the skill and experience of the anesthetist.

The intra-orbital and retro-orbital nerve trunks may be approached through the orbit, using the smooth bony surfaces and fissures as landmarks and guides, care being exercised always to keep the point of the needle in close contact with the bone, thus keeping away from the axis of the orbit which is the dangerous zone. But in extensive operations such as enucleation, the apex of the muscular cone of the eyeball is infiltrated intentionally. Two sites of puncture are usually adopted; the first, a little above the external angle of the palpebral fissure, is meant for the blocking of the frontal and lacrimal nerves; the second, a little above the internal palpebral fissures in the puncture point toward the nasal nerve.

If subcutaneous injections are made on each side of the ear from two points, one above and one below, and carried down to the deep fascia attached to the bone, the external ear may be anesthetized. When the auditory canal is involved a deep injection should be made at the root of the ear on its posterior aspect in order to catch the auricular branch of the vagus.

The entire region of the mastoid may also be anesthetized by subcutaneous and deep injections carried down to the bone. A speculum is then inserted into the ear and injections made into the superior wall of the auditory canal, at the junction of the bony and cartilaginous parts. Similar injections are made in the other walls of the canal. A small pledget of cotton moistened with 10 per cent cocain solution is then inserted into the tympanic cavity.<sup>2</sup>

In cases of severe trauma of the skull, the patients are very often in a state of unconsciousness which permits painless operations on the base of the skull by means of regional anesthesia alone; some of them, however, are restless and general anesthesia seems preferable. For the

resection of the posterior root of the fifth nerve in the treatment of trifacial neuralgia, as well as for any other extensive intervention involving the base of the skull, it is advisable to use rectal oil ether anesthesia combined with regional anesthesia to control the mental excitement of the patient who, under ordinary conditions, would not stand such a severe trial. This to our mind is a much simpler and safer method than inhalation narcosis, unless the surgeon is specially equipped for such operations and a specially trained anesthetist is available.

Fresh novocain-epinephrin solutions are the best. We make our solutions by dissolving sterile novocain powder in sterile normal salt solution (0.9 gm. of sodium chlorid for each 100 c. c. of double distilled water) and adding to every ounce of the novocain solution five drops of epinephrin solution (1:1000) immediately before use, irrespective of the strength of the novocain solution. But if no sterile novocain powder is available, the solution must undergo sterilization which may best be accomplished by making a half normal salt solution (0.45 gm. of sodium chlorid for each 100 c. c. of distilled water), boiling it gently for five minutes, throwing in the novocain powder, and boiling it for another couple of minutes and bringing the solution down to the temperature of the room, adding the solution of epinephrin just before use. Novocain solutions do not stand long or repeated boiling without deterioration, thus losing their anesthetic properties.

For operations on the skull, a 1 per cent solution is of sufficient strength to give rapid anesthesia of long duration without causing too extensive and too painful edema. For blocking the superior and inferior maxillary and the inferior dental and lingual nerves, from 2 c. c. to 3 c. c. of a 2 per cent solution is injected and for the infra-orbital or mental nerves, 2 c. c. of the same solution. For operations on the face, it is preferable to use small doses of a 1 per cent solution, so as to avoid the distortion of the anatomic features of the operative field.

As a rule, a hypodermic of scopolamin, 0.0002 gm. (1/300 gr.), and morphin, 0.01 gm. (1/6 gr.), is given one hour before the anesthesia is begun. This dose should be repeated half an hour after the first hypodermic if the patient is still nervous.

Shaving the scalp on or in the immediate vicinity of a wound and all other manipulations for purposes of disinfection are very painful. A good procedure is to shave a narrow circular band around the wound at about 5 cm. from its periphery and proceed with the anesthesia along that band. The wound can then be handled without giving pain and the operation performed without any supplementary infiltration.

#### BIBLIOGRAPHY

1. Allen, C. W.: Local and regional anesthesia. Philadelphia, Saunders, 1918, 674 pp.
2. Braun, H. F. W.: Local anesthesia; its scientific basis and practical use. Trans. by P. Shields. Philadelphia, Lea and Febiger, 1914, 424 pp.
3. Canuyt and Rozier: L'anesthésie locale et régionale en oto-rhino-laryngologie. Paris, Doin, 1920.
4. Duverger: Anesthésie locale en ophtalmologie. Paris, Masson, 1920, 95 pp.
5. Fischer, G.: Local anesthesia in dentistry, with special reference to the mucous and conductive methods. Philadelphia, Lea and Febiger, 1914, 270 pp.
6. Hirschel, G.: Text book of local anesthesia. Trans. by R. E. S. Krohn. New York, Wm. Wood and Co., 1914, 193 pp.
7. Pauchet, V., Sourdat, P. and Labat, G.: L'anesthésie régionale. Paris, Doin, 1920, 356 pp.

#### OCULAR TUBERCULOSIS

F. E. BURCH, M. D.  
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In a review of eye lesions met with and accepted as tuberculous manifestations, the making of a proper diagnosis and the principles underlying successful treatment are the two essentials of practical importance. We are enabled to recognize tuberculous lesions by certain characteristic clinical appearances based on cumulative reports of well-proven cases, by the age, personal and family history, of the patient, by the exclusion of other well-known causative factors, but chiefly by the aid of the tuberculin reaction.

The fact is noteworthy that ocular tuberculosis commonly occurs in patients who seem to be in fair general health, patients in whom no other evidence of organic disease is readily recognized. Frequently, however, the personal

\*Read before the Minnesota State Medical Meeting in St. Paul, October, 1920.

history reveals a former pleurisy, tubercular adenitis, bone or joint lesion, or the x-ray examination discloses a pulmonary fibrosis, (e. g. caseous bronchial glands) and Fuchs contends that a primary tuberculous focus, although not demonstrable clinically, must be assumed to exist.

The pathologic histology of lesions is always atypical, and does not conform to the usual microscopic picture of tubercle; tubercle bacilli in the tissues are demonstrated with great difficulty and while inoculation diagnosis is frequently positive, it is rarely possible. Therefore, the diagnosis must be made largely upon the clinical appearance and the tuberculin reaction.

Stock<sup>1</sup>, von Hippel<sup>2</sup>, Verhoeff<sup>3</sup>, and others have demonstrated beyond all doubt the precise tuberculous nature of certain definite eye affections, and the possibility of their reproduction by inoculation experiments. It has been possible to find the tubercle bacilli in some of the lesions, the characteristic tubercle in others, to obtain fairly uniform general, local, and focal reaction of these patients to tuberculin injections, the control or cure of numerous cases by tuberculin treatment and successfully to reproduce practically every type of ocular tubercular lesion in animals, by inoculation experiment. Verhoeff<sup>3</sup> believes the method of ocular infection is somewhat as follows: A child becomes infected with tubercle bacilli, perhaps, and usually, of the bovine type. With increasing resistance of the patient, lesions heal. With lowered resistance, recurrences develop. Through the general circulation bacilli lodge in the capillaries of the ciliary body, find access through the aqueous to the pectinate ligament whence they may produce scleritis, keratitis, iritis, etc., through metastasis or by way of the lymph channels.

Most cases of episcleritis, scleritis, and sclerosing keratitis, certain other non-ulcerative types of keratitis, about 10 per cent of anterior uveitis and iritis, and a few types of exudative choroditis and choroido-retinitis are proven tubercular in their etiology.

Exogenous infection of the eye lids, conjunctiva, cornea, and lachrymal sac occurs less frequently than one would naturally expect in view of the numerous possibilities of con-

tamination from the sputum. The lachrymal fluid and conjunctiva are not good nutritive media for tubercle bacilli growth and some authors expressed doubt that contamination ever occurs without injury.

Lupus, psuedo-trachomatous and granulomatous conjunctivitis or pedunculated coxcomb excrescences originating from the tarsal surfaces or from the fornix are the infrequent lesions met with outside the globe. Fistulous ulcers originating from the orbital periostium, more frequently in the neighborhood of the lachrymal sac, also occur.

Whether or not so-called phlyctenular keratitis and conjunctivitis may be classified as tuberculous lesions is a question still unsettled. Derby<sup>4</sup>, Davis<sup>5</sup>, Wilder<sup>6</sup>, Goldbach<sup>7</sup>, and many others have reported series of cases with from 70 per cent to 90 per cent of positive von Pirquet or tuberculin injection reactions, physical evidences of tuberculosis being found in the vast majority of patients. While this condition runs a rapid, acute course and generally recovers without tuberculin, Derby found that all cases did better when it was used. It is entirely possible that the phlyctenulae are the manifestations of the tubercle-toxins or the faulty products of metabolism incidental to tuberculosis and are not caused by direct infection.

In all probability a large majority of scleritis cases are tuberculous. The involvement of the cornea and the anterior uveal tract with the sclera is quite uniform. Torok<sup>8</sup> reports twelve out of fourteen cases of scleritis giving positive tuberculin reactions, ten out of eleven treated with tuberculin being cured. He believes tuberculosis to be the chief, but by no means the sole, etiological factor in this condition and emphasizes the association of scleritis, keratitis and irido-cyclitis, and believes, with Verhoeff<sup>3</sup>, that the infection is distributed to adjacent tissues from the filtration angle.

Verhoeff was able to obtain tuberculin reactions in all the thirteen cases (all females) studied by him. Histological examination of nodules in four of his cases showed focal proliferation of epithelioid cells, occasional giant cells surrounded by lymphoid cells, and no evidence of caseation. Tubercle bacilli could not be demonstrated. Corneal involvement frequently

accompanies scleritis as either a characteristic tongue-like or a crescentic yellowish-white infiltrate pushing in from the limbus on the affected side, usually with one or more discrete areas of greater density. Occasionally outlying opacities in the deep lamellae of the cornea with a dense opaque center, gradually fading out into the surrounding layers like partially developed miliary tubercles, may be seen. There is slight if any tendency toward vascularization until well advanced stages. It is not uncommon for the corneal infiltrate to be separated from a border lesion at the limbus by a zone of clear cornea. The whole process may undergo complete regression under favorable conditions, as illustrated in the following cases.

*Case I. Scleritis with Keratitis.* Mr. J. P. C., 25, married, came on July 7th, 1915, complaining of inflammation of the right eye of four weeks duration, with inability to use his eyes in his near work on account of lachrymation and headaches. Vision R. E. 20/20???; L. E. 20/15. Examination showed an episcleritis in the right eye over external rectus insertion with a moderate nodular elevation, but no corneal involvement, which responded to treatment with atropine, mercuric oxide, and dionin in the course of a few months.

July 18, 1916, following an attack of mumps in Winnipeg, the right eye flared up in the same manner, with slight ciliary congestion also in the left eye. Vision in each eye was normal, but it was impossible for him to do any sustained work. There was an increasing ciliary congestion and gradually he developed a typical mild scleritis in each eye which did not materially improve under local treatment with atropine, heat and yellow oxide.

Dr. Turnbull of Winnipeg gave tuberculin tests twice which were reported by the patient to have been negative. The Wassermann was negative. Focal infection was found on radiographic examination of three teeth which were properly treated, but without any manifest improvement. The chest was negative. The clinical picture at this time was that of mild iritis and scleritis localized in distinct areas around the limbus but not extending far back from the cornea-scleral border. The fundi and media were normal.

Tuberculin injection, 2/3 mg. gave distinct reactions. In addition to local treatment with atropine, mercuric oxide, dionin, heat, dark glasses and at times, the use of the cautery over the lesions after the manner of Dupuy-duTemps, old tuberculin in doses of 1/10 to 1/2 mg. was given at weekly intervals over a period of nearly four months without, however, at any time producing any decided local or focal reactions, and with temperature on only a few occasions. The corneal lesions developing during this period consisted in the right eye of typical infil-

trations proceeding from the limbus, from two separate points, and in the left eye from three points, each having its origin from the limbus corresponding to the areas of greatest inflammation on the sclera. In each instance the infiltrated areas began to clear from the limbus, leaving clear cornea between the border of the cornea and what became ultimately detached corneal opacities. In the left eye there developed eight distinct dots of denser opacity, but none within the pupillary area and vision continued good.

No attempt to do any eye work was allowed during practically all of 1917, the patient being out of doors a good deal and in very fair physical condition. There being very little permanent improvement, von Hippel's method of giving very small doses of tuberculin was employed, without any decided improvement, and after a few months of this the use of fairly large doses was again resorted to, at times as much as 4 mg. and 5 mg. being given without marked reaction.

In August, 1917, there was distinct increase in the iritis for a few weeks, which was controlled by increasing the strength of the scopolamine. The condition of the eyes was becoming exceedingly chronic and at the suggestion of Dr. Longstreet Taylor, a change in the tuberculin was made. At my request, Dr. Taylor gave the tuberculin from now on, using Von Ruck's watery extract, in gradually increasing doses at weekly intervals for six weeks with periods of rest, with very slow but satisfactory results. The tuberculin was continued at intervals during the whole of 1918, vision remaining practically normal throughout the course of the disease owing to the nonexistence of corneal infiltration in the pupillary area.

The improvement was gradual, the scleritis fading out very slowly with no new areas of involvement. The corneal opacities never became vascularized although here and there during the height of the inflammation one could make out new vessels emanating from the limbus for very short distances. The corneal opacities cleared up to the point where they were not noticeable to the naked eye, but examination with the loupe showed remaining deep nebulae at the points corresponding to the densest infiltration.

Severe adenitis, with suppuration of cervical glands necessitating operation developed and was operated upon on July 22, 1919 by Dr. John Cameron of St. Paul. Recovery was prompt and no further trouble developed.

On October 22, 1919, vision with correcting lenses was R. E. 20/15; L. E. 20/20. Examination of the fundus showed nothing abnormal and apparently it had remained uninvolved during the course of the disease. On August 5, 1920, vision was normal and there had been no recurrence, the patient being in excellent health and able to use his eyes normally.

In this case, the eye involvement was fairly typical, and both eyes were affected practically alike; re-



sponse to tuberculin treatment was not apparent although faithfully persisted in (with perhaps too large dosage), until a change in the product used was resorted to. Tuberculous adenitis developed following injections, but ultimately recovery was complete and there was no permanent impairment of either eye.

*Case II. Sclerosing Keratitis.* Mrs. H. K., 31, married, referred by Dr. Christianson of Morris, Minnesota, came on August 14, 1919, complaining of intermittent pain, redness and impaired vision of the left eye since February, 1919. The right eye had been enucleated several months previously after becoming entirely blind from inflammation resembling that now present in the left. The present inflammation in the left eye began before the right eye was enucleated.

The family and personal history, eyes excepted, was negative. General physical examination was negative excepting pregnancy advanced to the sixth month. Wassermann negative on two tests. Local treatment with heat, atropine, and dionin was instituted and mixed treatment begun.

Examination of the eye showed typical scleritis with nodular elevation at two distinct points around the limbus, deep ciliary congestion, moderate iritis and cornea nebulous at two distinct locations corresponding to the sites of densest infiltration over the sclera. The corneal opacities were entirely interstitial and avascular. There were a few scattered fine punctate opacities in the interstitial substance of the cornea. No. K. P. Vision was 20/150.

The temperature was normal for 48 hours, and on August 16th, 0.5 mg. of "O. T." was given subcutaneously, with mild general, local, and focal reaction. Temperature 99. The local treatment was continued, while tuberculin was administered at intervals of three days, using new tuberculin "T. R.". There were slight reactions at times and on two occasions a suspicion of increased focal congestion following the injections, but no elevations of temperature. A series of twelve injections were given during the first course of tuberculin with decided improvement in the eye condition.

When seen again on October 27th, after a short series of injections by her home physician, the eye presented evidences of renewed inflammation. There was a new area of corneal infiltration projecting upward from the limbus at its lower border, a tongue-like projection with denser opacity in its advancing margin in the deepest layers of the cornea. The previous principal corneal infiltration above, was no longer connected with the limbus and showed a distinct zone of clear cornea between the limbus and the corneal opacity. At three distinct points over the sclera there was what seemed like phlyctenular elevations of episcleral tissue. These were treated locally with iodine and iodoform powder and ultimately disappeared entirely.

Tuberculin treatment was resumed November 17th with one minim doses of "T. R." 1:1000, which were

given at intervals of seven days each. The eye continued to improve under treatment as the tuberculin dosage was gradually increased to 1/5 and finally to 1/3 mg., and on December 27th, 1919, the eye had lost most of its deep injection with decided lessening of the scleral inflammation and beginning regression of the corneal opacities. Vision on December 3rd was 20/100.

In January, 1920, a perfectly healthy child was delivered without complication, the mother made a good convalescence, and the child has thrived. Two weeks after delivery, the mother developed bronchitis of a mild type which cleared up promptly. Examination of the sputum was negative for tubercle bacilli, during the bronchitis attack.

On February 17th, with correcting lens, vision had improved to 20/30 and the eye appeared entirely quiet; there was no redness and with the exception of the corneal opacities, the eye appeared normal. There remained, however, a deep bluish tinge to the sclera. Tuberculin injections were continued by her home physician at lengthened intervals, the local treatment consisting entirely of yellow-oxide ointment and dionin, for the purpose of clearing up the corneal opacity. On April 15, 1920, vision was 20/30 without cycloplegia, the eye was quiet and there had been no recurrence. On July 9, 1920, the eye was still quiet and excepting for the corneal opacity, had cleared up. There was no change in vision.

In all there had been given a total of about forty injections of T. R. besides the local treatment. Dosage was not the small infinitesimal amounts advocated by von Hippel and others, but was given to the limit short of reaction, the amounts never, however, exceeding eleven minims of 1:1000 sol. "T. R." The improvement manifested was, in my opinion, not entirely the result of tuberculin treatment and it is not conceivable to me that the inflammation could be entirely cleared up without the use of local measures. I consider the treatment aside from local measures, a valuable adjunct in securing the excellent results obtained in this case.

The scleritis usually clears up more rapidly and completely than the keratitis, but leaves a peculiar pale bluish sclera which is also quite characteristic. In three of the scleritis cases treated by the writer with tuberculin an adenitis developed, and in two of these removal of suppurating glands was required. In episcleritis the process less frequently involves the cornea. In both scleritis and episcleritis, females are affected about 3 times more frequently than males.

Mutton-fat deposits on Descemet's membrane often involving the deep lamellae, not infrequently accompany tubercular iritis or uveitis. These are not metastases from foci in the fil-



tration angle but are merely masses of leucocytes collected from the aqueous, such as occur in the ordinary manner with any cyclitis. They simply form larger masses in the tuberculous process. The damage to vision resulting from severe sclerosing keratitis may be marked and has led to complete blindness in both eyes in two of the writer's patients.

The following case illustrates the extreme impairment of vision occasionally occurring as well as the length of time which may elapse between involvement of the first and second eyes.

*Case III.* L. L., unmarried, 25, referred by Dr. C. L. Greene, came on August 26, 1909, on account of a blind and inflamed right eye. Left eye was normal in appearance and vision was 20/15. Examination of the right eye showed moderate ciliary congestion over a deep bluish discolored sclera (typical of healed anterior uveitis), moderate ectasia of the sclera, an entirely opaque cornea from what had apparently been a sclerosing keratitis. Vision nil, tension plus. In the cornea could be distinctly seen new formed vessels of considerable size. There were areas of denser and other of lesser opacity; in places the iris entirely invisible, in other areas the iris visible through the less dense opacity, lying close to the cornea with very shallow anterior chamber.

The left eye at this time showed vision 20/15, the cornea, media and fundus were normal, and several examinations of the sound eye between August, 1909, and April 6, 1916, showed nothing abnormal. When examined on the last date named, the patient complained of photophobia, but nothing could be detected to account for the trouble. Tinted lens in her distant correction relieved her complaint.

The family history was bad, one brother and one sister dying of pulmonary tuberculosis. The personal history was exceptionally good, the patient robust and except for the usual diseases of childhood, there had been no serious illness.

Physical examination by her family physician, Dr. McLain of Fergus Falls, and by Dr. Greene had not evidenced any pulmonary or other trouble excepting eight root abscesses in teeth, which were extracted. There were some recurrences of inflammation in the blind eye at intervals, controlled by local treatment. February 13, 1917, the patient came for treatment because the left eye was inflamed and irritable to light. Examination showed two distinct areas of episcleritis, one over the external, the other over the inferior rectus muscle, with distinct nodular elevation and quite intense local injection. This attack was treated with local measures for six weeks with favorable results. Recurrence developed a few months later and she consulted a number of oculists who believed the condition due to interstitial keratitis of doubtful or possible tuberculous origin. The Wassermann tests were negative. Physical examination at the Rochester Clinic showed nothing bearing upon

the etiology. Tuberculin treatment had been instituted by Dr. Carl Fischer of the Mayo Clinic and he considered this the most probable cause of the old lesions in the blind right eye.

Tuberculin test given on February 20, 1917, was distinctly positive in all phases and tuberculin treatment with small doses was begun and carried out, injections being given to the point of tolerance short of reaction for several weeks. The cornea of the left eye was considerably involved in the inflammatory process at that time, typical sclerotic areas of infiltration developing during the course of what may be termed a fugacious scleritis in which the intensity of scleral inflammation shifted from time to time, around the corneo-scleral ring. More definite elevations appeared from time to time over the insertion of the recti muscles, subsiding only to reappear. There was always more or less ciliary congestion. New points of infiltration appeared at the limbus invading clear cornea until there was practically no point in the periphery of the cornea uninvolved in the process. The central area of the cornea remained uninvaded until September, 1917, when vision was reduced to 6/100, vision being obtained through an eccentric area of cornea above the normal pupil with the aid of a dilated pupil.

The eye ultimately quieted, but without regression of the corneal opacification so that when last seen there was practically complete loss of vision. Seven years had elapsed between involvement of the first and second eyes.

In this case, tuberculin was used intermittently by several oculists. The dosage varied from 1-3000 mg. to a maximum of 3 mg. which was about the limit of tolerance short of reaction. The failure of treatment to effect a cure in this case, the inability to establish an immunity or promote regression of the process is one of the few instances in which I was unable to note any favorable action.

(Unfortunately, one cannot always report cures.)

Cases of typical parenchymatous keratitis in children are frequently reported as tuberculous. There can be little doubt that the vast majority of them are luetic and assuredly a far larger percentage of cases respond to the Wasserman than to the tuberculin test. One rarely sees a juvenile patient with parenchymatous keratitis not clearly of syphilitic origin. Whether originating from either cause the clinical picture is practically the same.

An exhaustive study of iritis by Brown and Irons<sup>8</sup>, including careful history and physical examinations to detect evidences of focal infections, syphilis, and tuberculosis including tuberculin tests, proved tuberculosis to be the sole cause in 8 and a coincident infection in 16 of 100 cases studied.

When tubercle nodules are lacking and in the

absence of evidence afforded by other diagnostic tests, or when no other focal infection can be found, serious consideration of a possible tuberculous etiology depends largely upon obtaining a positive tuberculin test, especially in cases which are chronic, or at least indolent under other forms of treatment. In nodular iritis, in which, as Tooke<sup>3</sup> affirms, "there is no site of predilection for the nodules either at the root or pupillary margin of the iris"; no matter what the Wassermann tests may show, von Pirquet or subcutaneous injection tests should be given. In a series of cases reported by Tooke, he states that "the nodules are more numerous on the posterior than on the anterior surface of the iris. One can only find giant cells in those cases where the process has been active for months and tubercle bacilli could be demonstrated only in cases where central caseation of the individual tubercle had occurred". The thickness and infiltration of the iris may make the detection of nodules very difficult and here the corneal microscope is of value. The iris is rarely involved without the clinical picture including, that of a more or less chronic uveitis. Torok<sup>4</sup> found about one-half of his tuberculous uveitis cases were benefitted by treatment with tuberculin. The following cases are fairly typical of chronic tubercular irido-cyclitis or anterior uveitis.

*Case IV.* Mrs. W. S. R., referred by Dr. W. H. Dodge, Farmington, Minnesota. This patient came February 25, 1917, complaining of blurred vision with the right eye of one week's duration. She stated that permanent impairment of vision in the left eye dating from 1910 had begun exactly like this attack. Vision in the right eye was 20/50; in the left eye 20/100.

Examination of the right eye showed a dull cornea due to descemetitis and clouded aqueous, slight thickening of the iris with few synechia, but accompanied by very little pericorneal congestion. The iris while thickened did not at this, or at subsequent examinations, show any distinct nodules. The eye picture was that of a chronic, low-grade uveitis.

Examination of the left eye showed the cornea clear except for one permanent sharply defined opacity, very small and almost in the center of the cornea. The anterior chamber normal in depth, the iris containing evidences of old iritis in the iris folds and a thin layer of organized exudate almost completely, but not entirely occluding the pupil.

The family and personal history contained nothing bearing upon the eye condition. The physical examination of the patient was negative, but she was

under weight, tired out, nervous and subject to attacks of indigestion marked by hyperacidity. The Wasserman was negative on this and later examinations. Radiographic examination at a later date showed an old fibrosis in the apex of the right lung, but there were never found any evidences of active tuberculous trouble.

Under local treatment alone, the right eye cleared up from this attack in about four weeks, vision being normal when tested on April 26. May 15, there was a slight recurrence similar to the first, responding less rapidly to treatment; the deposits on Descemet's membrane were slow in disappearing.

May 26, one mg. of "O. T." was given, followed next day by focal and local reactions, but with practically no general reaction. On May 31, a three mg. injection was given with decided reactions, local, focal, and general, temperature reaching 102°. Under combined local and tuberculin "T. R." injection, the eye steadily improved, the K. P. disappeared, and the condition remained quiet under systematic treatment for about three months.

October 13, 1919, there was return of the condition with more ciliary congestion than previously, vision again fell not only in this eye, but in the left which had remained quiet for seven years and continued to drop with each of the slight exacerbations which developed in one eye or the other during succeeding months. There was little variation in the clinical appearance of the eyes—that of a low-grade chronic uveitis characterized by tiny but numerous deposits on Descemet's membrane which were never of the mutton-fat type. On the contrary, in this case they were unusually fine and at times, practically alike in both eyes. The pupils became more or less occluded by a thin film of organized exudate. Vision on January 28, 1920, had dropped to R. E. 8/65; L. E. 1/200. The sclera was uninvolved in the process at any time.

A period of one month's rest in bed, stimulation of metabolism with endocrine therapy (small doses of Thyroid extract, alternated with anterior lobepituitary extract) and continuation of small doses of "T. R.", 1/1000 mg., resulted in gradual improvement in the uveitis. On account of the pupillary exudate vision remained the same on Sept. 1, 1920, as above.

Tuberculin was faithfully and persistently used over a period of eighteen months, with periods of intermission, no reactions of consequence occurring, even when the dose had attained five mg. There was gradual increase of 24 pounds in weight.

The local treatment of the eye consisted of cycloplegics and local lymphagogues, heat and dark glasses. During 1917 with the first attack subconjunctival injections were given with some benefit apparently, later discontinued when the condition was definitely diagnosed.

This patient is still under treatment and observation and while there have been almost no active manifestations of trouble in either eye for the past nine months, I do not consider her a cured case. I think

the tuberculin has had a most beneficial influence upon the progress and possibly has permanently stopped the disease.

*Case V. Anterior Uveitis.* Mrs. P. T., age 39, came on January 11, 1917, complaining of persistent inflammation of right eye dating from April, 1916, which had not improved under atropine, heat, collyria, etc. The left eye had been similarly affected and was now quiet.

One sister had died of tuberculosis at age of twenty-five. The patient had typhoid fever at age of ten and has had cervical adenitis since childhood. She has had four children and one miscarriage in the fourth month. Three of the children are living and well. The other child died of erysipelas when two years old. The patient has not had tonsils removed, but many teeth have been extracted on account of apical abscesses. Examination of nares shows enlarged middle turbinates, sinuses clear, and no evidence of focal infection in the nares or mouth. Wassermann's taken at this time and subsequently were negative.

Examination of the right eye showed moderate pericorneal injection, iris not thickened or adherent, and anterior chamber normal. The sclera was infiltrated over about the anterior third of its exposed portion with two areas of denser brawny thickening. There was slight corneal involvement—a faint nebula near the temporal margin. The fundus was normal and media clear. Vision was 20/40.

The left eye showed typical blue sclera without distinct staphyloma. There was no ciliary congestion. Tension was slightly minus. From all borders of the limbus there were small irregular opacities extending toward the center of the cornea. Within and partly filling the pupillary corneal area there was an interstitial opacity. Old blood vessels projected from the limbus toward the center of the cornea from many points. There was more or less interstitial haze throughout the cornea. Vision was 20/50 minus.

The temperature was normal for four days. On Jan. 20, 1917, 1 c. c. "O. T." 1:1000 produced local, focal, and general reaction. Temperature 99.6. In addition to local treatment with atropine, tuberculin treatment was given systematically at intervals of five to seven days. The patient was found to be exceedingly sensitive to tuberculin and several complete reactions were produced, necessitating careful regulation of frequency and size of dosage.

Susceptibility to atropine was also marked, although scopolamine could be used in weak solutions without irritation.

During February and March, 1917, nodular episcleritis developed over the insertions of the external and superior recti. These were cauterized lightly and treated with iodine locally without benefit. The area of infiltration over the superior rectus continued thickened and there developed a projecting tongue of corneal infiltrate from this margin with

new corneal vessels pushing into the corneal stroma in June, 1917.

During the summer of 1917, several teeth were extracted invariably followed by exacerbation of the ocular inflammation. August 28, 1917, there was moderately severe iritis with pupil only partially dilated under atropine. Temperature reactions occurred when dosage of "O. T." was increased from 2 to 3 mg. During succeeding months of continued faithful treatment there were periods of improvement and exacerbations quite typical of chronic ocular tuberculosis, the improvement being noticeable when the patient could secure sufficient rest and freedom from domestic work and responsibility. It was frequently necessary to decrease the tuberculin dosage and then increase cautiously. It was definitely ascertained that if dosage was not increased over one minim to 1:1000 "O. T.", no reaction occurred and progress was possible. This patient has been under almost continuous treatment and observation over a period of three years, tuberculin being employed at regular intervals, with intermissions. There has been no recurrence of trouble in the left eye.

Examination on September 23, 1920, shows the left eye practically the same as when first seen; in the right eye, the anterior segment of the sclera shows a peculiar mixture of blue-slate discoloration without episcleral thickening, the superficial bulbar conjunctiva slightly congested. The deep ciliary vessels are visibly congested. The anterior chamber is normal and iris not unduly thickened nor adherent. There is slight haziness of the vitreous, the retina and nerve are normal although veins appear enlarged in calibre.

There are several tongue-like corneal infiltrations separated from the limbus by clear areas of cornea, traversed by new formed corneal vessels. Several small outlying discrete opacities, round, about  $\frac{1}{2}$  to 1 mm. in diameter suggest tiny miliary tubercles, one of these fading off into surrounding tissue on all its borders. Vision is 20/40 minus.

The eye has become fairly quiet and rarely becomes severely inflamed, but cannot be pronounced cured. It is improved. One cannot say that this patient received the slightest evidence of continued improvement until dosage was definitely held down (1-15 mg. maximum) and until she was given sufficient rest and tonic treatment to raise general resistance above normal.

(Patient shown at the meeting).

In the choroid we meet with three distinct forms of lesions: conglomerate tubercle, which is fairly rare, miliary tubercles in the choroid, and exudative choroiditis.

Conglomerate tubercle is frequently mistaken for neoplasm and may resemble glioma. In either case the condition always necessitates enucleation. Miliary tubercle of the choroid, I believe is much more frequent than is com-

monly supposed. The tubercles are fairly true to type and when seen in the acute state, appear ophthalmoscopically as irregular patches of yellowish gray exudate or as slightly elevated oval or irregular areas with poorly defined margins, often obscured by exudate in the adjacent vitreous. They usually lie under or at the side of one of the larger vessels, or the retinal vessels may course over them. In the later stages and in old processes which have healed, pigment changes occur, without, however, any characteristic picture.

Exudative choroiditis with multiple yellowish patches, especially along the vessels at the equator, or as single lesions in any part of the fundus, leaves atrophic areas which become whiter with time. The diagnosis must be based upon the ophthalmoscopic appearance, absence of syphilis and focal infections, and positive tuberculin reactions.

It is difficult to separate choroidal from retinal lesions. Frequently the patient complains of either localized or diffuse impairment of vision due to vitreous exudate that cannot be definitely connected with any retinal lesion, the ophthalmoscope revealing nothing other than the vitreous exudate. Careful search sooner or later may reveal the origin of the exudate or hemorrhage emanating from a retinal vessel, usually a vein. These retinal vitreous exudates may undergo complete absorption, but not infrequently they become organized and vascularized, or may become fibrous bands of tissues which present the picture known as "retinitis proliferans". For the most part, the hemorrhages occur in young adults who apparently are in good health. There is distinct tendency to recurrence. Diagnosis in these cases must as Jackson<sup>1</sup> has pointed out, be based upon the "vitreous opacities, recurring retinal and vitreous hemorrhages, enlargement of the retinal veins, local lesions associated with large retinal vessels, white spots in the macula in some cases, optic neuritis, and 'retinitis proliferans' as a terminal condition; the earlier lesions giving reactions to tuberculin injections, and their involution favored by tuberculin therapy". Cases typical of this type follow.

*Case VI. Choroidal Tubercle.* F. O., 17, referred by Dr. Oliver Porter, of Atwater, was first seen August 13, 1920, complaining of dimness of vision and corneal nebula over left pupil, first noticed four

months previously. The corneal opacity was not dense. During the previous few weeks, the condition advanced rapidly with increasing impairment of vision. General health had been good and there was nothing of importance in the personal or family history.

Examination of the left eye showed marked pericorneal injection with a dense grayish, irregular, somewhat circular opacity in the interstitial substance of the cornea, the edges somewhat sharply defined. While Descemet's membrane seems to be partly covered with a layer of exudate, there were no definite K. P., although many criss-cross lines.

Vision in the left eye was 20/70. The right eye appears normal, vision 20/15, fundus negative.

The physical examination, physical and fluoroscopic examinations, urinalysis and Wassermann tests were negative and the blood count and hemoglobin tests were normal. When first seen the patient was running one degree of temperature daily. Treatment locally with atropine, dionin, and heat caused the ciliary congestion to subside, the cornea became less clouded, vision improved and the view of the fundus was more easily obtained. Small K. P. could now be seen on Descemet's membrane. The fundus picture was that of a quite distinct tubercle-like structure in the upper nasal field; a central whitish-yellow mass, irregularly oval in shape surrounded by pigment deposit, lying adjacent to the superior nasal vein the mass being about 5 mm. in length through its greatest dimension. In the vitreous and apparently connected with the tubercle itself, a fairly organized mass of exudate projected obliquely forward as a grayish membrane.

August 25th, vision was 20/25, temperature was practically normal and continued so. September 1st, one c. c. of "O. T." was injected subcutaneously without any reaction whatsoever.

September 10th, a two c. c. injection of "O. T." was given with distinct general reaction, but with no apparent change in the fundus condition. Vision at this time was 20/20 with correcting lenses the cornea had cleared, and the patient returned to her home. Directions were given for the continued injections of "T. R." in doses short of reaction by her home physician.

The diagnosis in this case rested largely upon the ophthalmoscopic appearance, the absence of other focal infections and a general reaction to tuberculin. While local treatment seems to have caused the symptoms to subside with unusual rapidity, the process is to be considered as one of a tubercle of many months duration, lighting up suddenly with an explosion of exudate into the vitreous, descemetitis, with a mild accompanying keratitis and iritis. The patient's excellent general condition and the establishment of an immunity probably accounts for the rapid improvement under treatment. Further observation will, in all probability, show manifestations when resistance again becomes lowered.

*Case VII. Retinal tubercle.* Mrs. S. M. P., Duluth,



26, in good general health and without definite personal or family history of tuberculosis, came June 18th, 1917, complaining of impairment of vision in the left eye on two previous occasions. She had been seen by Dr. Casey Wood of Chicago and by Dr. Schneider of Milwaukee. The first attack occurred in the summer of 1915, the second in March, 1917.

Vision in the right eye was 20/20++, left eye 20/20??. Ophthalmoscopic examination showed what had, apparently, been a small retinal hemorrhage along the inferior temporal artery almost bordering upon the disc margin. There were two distinct nodular masses with a third small patch of exudate along the vessel, grayish-white in color, without appreciable pigment change, the vessels passing partly over these masses which were about one-third and one-fourth disc diameter in size. As the patient could not remain for further study at the time, and in view of the fact that vision was reported as improving, no tuberculin test was given.

September 15th, the patient was again examined on account of a recent further impairment of vision and showed the condition practically unchanged as regards the appearance of the tubercles, but there was distinct clouding of the adjacent vitreous with some "soot" throughout the fluid. However, vision was 20/25. The macula appeared normal and there were no new lesions visible in either fundus. Examination of sinuses and tonsils was negative. The urine and blood were negative.

Physical examination by Dr. H. L. Taylor, with x-ray findings by Dr. Cole of Pokegama Sanatorium showed: "Tubercular glands of the thorax and recent involvement of the right apex. The glands along the lower bronchus of the right lung show numerous beaded and calcified appearance." General and local reactions were obtained after the third test with the three mg. of old tuberculin, without changes in the retinal focus. Patient was sent to Pokegama, where in addition to rest and tonic treatment, she received a course of von Ruck's serum, and where she gained in weight.

March 3, 1918, examination showed the condition quiet, vitreous clear, no change in the appearance of the tubercles except an apparent shrinkage in size with less elevation. Vision was practically normal with correcting lenses. Patient had gained 16 pounds in weight, the lungs were free from symptoms and general health excellent. She had continued with tuberculin treatment under the director of Nopeming Sanatorium. When examined again in August, 1918, the tubercles appeared replaced by connective tissue, with some pigment changes.

October 6th, 1919, again examined on account of recent slight blurring of vision. There was a very slight amount of exudate in the vitreous, but no appreciable change in the lesion. Vision was normal. A course of immunizing injections was given by Dr. Laird with Deny's "B. F." tuberculin beginning with 1:1000 mg.

When last seen April 17th, 1920, vision had re-

mained normal and no further change observed in the now atrophic tubercle scars.

This patient, observed over three years, showed what probably quite typically occurs in miliary retinal tubercle under favorable conditions and with established immunity. The condition was one of undoubted tubercle of the retina without damage as yet to vision, made possible of diagnosis by associated physical evidences, tuberculin reaction and the clinical appearance ophthalmoscopically.

The whole subject of tuberculin is interesting and of unusual importance in the diagnosis and treatment of the conditions described. The focal reaction is of the greatest value (the evidence consisting mainly of an increased hyperemia), but general and local without definite focal reaction are of sufficient value to aid diagnosis. The evidence afforded by reactions may be interpreted wrongly and fallacious deductions are easily possible. Naturally, the possibility of positive general reactions in all adults makes it injudicious to invariably accept the test at its face value; all the evidence must be carefully sifted, tests must be repeated, other foci of infection must be sought for and considered in the etiological diagnosis.

The routine test with old tuberculin gives most reliable results for diagnosis although the von Pirquet test is used by many oculists who recognize and fear the dangers of realighting latent foci by marked reactions in the eye. Especially in retinal lesions where the focal reactions cannot always be easily observed, damage to vision may result from the excessive hyperaemia characterizing marked reactions. H. Wood<sup>2</sup> had cited instances of harmful effect upon vision, believes focal reactions should be avoided in intra-ocular lesions and urged the avoidance of tuberculin as a therapeutic measure in acute cases. He believes its use should be reserved for non-progressive chronic cases, and further urges ophthalmologists to conduct treatment with tuberculin "under the guidance of one trained in immunologic problems". There is no such thing as uniform dosage in the use of tuberculin, as all who have used it much can testify. For those who only occasionally need to make use of it diagnostically or therapeutically, team work with the internist is both desirable and advisable.

In the diagnosis of any suspected eye lesion, the physical examination, case history, roentgenology, nose and throat examinations, and



search for other evidence of focal infection, etc. should never be neglected. There can be no doubt that, when correctly used, tuberculin is one of our most valued aids. So far as concerns ocular tuberculosis at least, it is uniformly agreed that therapeutic dosage should always be short of reaction and very cautiously increased with the sole purpose of developing immunity while also increasing resistance by proper hygiene, rest, food, tonics, etc. The majority of cases, as already stated, requiring more than local treatment are progressive cases of the chronic type and the results of tuberculin therapy, especially in lesions of the anterior quadrant of the globe, are distinctly good. It is possible that fundus lesions, because of the ophthalmoscopic difficulties of observation do not convince us of its value so satisfactorily as in those conditions easier of study. In general its use affords the ophthalmologist a valuable weapon in the treatment of tuberculous lesions of the eye which are not so rare as formerly believed, but which because of their chronic course, present so many difficulties of treatment.

## BIBLIOGRAPHY

1. Stock: Klin. Monatsb. für Augenheilk., 1903, p. 228.
2. von Hippel: Roemer's Textbook, p. 181-183.
3. Verhoeff: Boston Med. & Surg. Journal. 1907, p. 317. Journal A. M. A. 1914, July 4, p. 13.
4. Derby: Trans. Ophth. Soc. 1908. (Vol. 9, p. 540.)
5. Davis: Oph. Sec. A. M. A. Trans. 1913, p. 181.
6. Wilder: Oph. Sec. A. M. A. Trans. 1910, p. 136.
7. Goldbach: Oph. Sec. A. M. A. Trans. 1917, p. 286.
8. Torok: Archiv. of Ophth. Vol. XLVIII, 1919, May, p. 242.
9. Brown and Irons: Journal A. M. A. Vol. 66, p. 1840.
10. Tooke: Am. Jour. of Ophth., 2, 1919, p. 395.
11. Jackson: Archiv. of Ophth. Vol. XLV, 1916, p. 552. Annals of Ophth. Vol. 25, p. 84.
12. H. Wood: Annals of Ophth. 1917, April, p. 223.

## DISCUSSION

DR. W. W. LEWIS, St. Paul: Tuberculosis in ophthalmology has been of deep interest to me because of early impressions. In my preparatory work I heard Professor Utthoff of Breslau remark that he believed tuberculosis would rapidly become one of the largest subjects in the pathology of ophthalmology. I heard Lauber of the Dimmer Clinic say that he believed that all cases of spontaneous intrabulbar hemorrhage in young adults were from tuberculosis. Now after many years Jackson's paper on that subject has rekindled our interest. Since I have been especially interested in this subject I have kept in close touch with Dr. Boeckman Sr., and Dr. Burch

and their interest in it has intensified my interest. Dr. Burch's paper of 1917 I considered a very valuable contribution to the subject. I believe the blanket diagnosis of syphilis for most ocular lesions will be rapidly broken down and tuberculosis and focal infection will rapidly supplant such diagnosis in most cases. The old order of ocular diagnosis, which was syphilis, focal infection and tuberculosis, I believe will be in the future either tuberculosis or focal infection first, and syphilis last. We know that in general postmortem findings a great percentage of subjects have shown tuberculosis why not the same proportion in ocular lesions? Why can we not deduct from that that the presence of tuberculosis in ophthalmology is more frequent than is generally supposed at this time?

The recognition of tuberculosis in ophthalmology has been slow. Tuberculosis of the episclera and sclera though slowly recognized at first is generally thought now to be of tuberculous origin by most eye men. While frank cases of eczematosa of the cornea in children have been recognized, I think the tendency to overlook eczematosis in adults has been common. The lesions in children are very marked and typical of the phlyctenular type. In the adult the lesion is more often in the center of the cornea and is not recognized as eczematosis. Sclerosing keratitis recently has been regarded as tuberculosis, but then this form has not long been regarded as tuberculosis when it appeared in the very acute form with so-called tongue-like vascular projections radiating from the limbus, that Dr. Burch spoke of. There is another form of keratitis which has deeply interested me and which I believe is tubercular. That is the rather sudden appearing multiple, discrete superficial ulcers of the cornea, well separated from the limbus, and of intense infiltration sharply defined by clear uninfiltreated corneal tissue. In adults, over night, a group of these ulcers will appear and rapidly break down into open ulcerations. The very marked symptoms will soon subside under atropine and heat and clear up but will recur again and again. I would like to say considerable more about this subject, but I do not believe the time will permit.

DR. W. R. MURRAY, Minneapolis: Ocular tuberculosis is not nearly as infrequent as generally supposed, as shown by the statistics that Dr. Burch has quoted. This is a phase of tuberculosis that is extremely interesting. The mode of onset in ocular tuberculosis is often difficult to explain. It may be that it occurs from sources outside of the eye, as in certain cases of conjunctivitis of tuberculous origin, and possibly in some cases of corneal infection. However, it is generally accepted that the infection is secondary to some other focus of infection in some other part of the body, although it is sometimes difficult to ascertain this focus of infection. I think it is rather unusual to find ocular tuberculosis in a subject with pulmonary tuberculosis.

I would like to report a case which is now under my observation and the patient is present in the hall

if any one cares to examine the case. It is one that is very typical. A woman, aged 43, consulted me in November, 1911, on account of an inflamed left eye. Six months previous the left eye had become inflamed and painful and after some treatment the condition subsided. Two months later the eye again became inflamed. Four days before I examined her a white spot appeared in the corneal substance. The history of the patient is somewhat negative. She had a mild arthritis at the age of 18; double ovariectomy at 25. Seven or eight months preceding the onset of the eye trouble she had taken care of a relative with pulmonary tuberculosis.

Examination of the left eye showed the presence of sclerosis and areas of infiltration in the cornea. The iris was normal with normal pupillary reaction. There was no clinical evidence at that time of involvement of the uveal tract. There was some injection of the sclerotic vessels. The right eye was normal. The condition seemed to be one of corneal involvement with some injection of the vessels of the sclera.

Four days later I referred the case to Dr. Head for general physical examination. This was negative; no focus or infection found. A diagnostic injection of tuberculin was given by Dr. Head, which resulted in marked local and marked general reaction. Following this diagnostic injection of tuberculin there was an increase in the injection of the vessels of the sclera about the margin of the cornea and the corneal infiltration seemed to become somewhat more active. The condition seemed to progress slightly though not markedly. Therapeutic doses of tuberculin were then given, when the active condition subsided, beginning with 1/00000 of a milligram and increasing to 1/500. After this treatment the condition cleared up somewhat. I did not see the case again until 1920. The left eye had remained quiet during that period. In 1920 the patient returned with a somewhat similar condition in the right eye. A diagnostic injection of tuberculin was given consisting of 1/25 c. c. of tuberculin from the Bureau of Animal Industry at Washington, which corresponds to 4 mg. of old tuberculin. This was followed by a marked reaction in the right eye and the lesion spread over the entire cornea. She presents a typical picture of tuberculosis of the cornea. I have a water color sketch of the eye here which shows the condition very well and perhaps you can get a better idea from the picture of the extent of the lesion.

DR. PAUL D. BERRISFORD, St. Paul, Minn.: The employment of tuberculin in ocular tuberculosis is recognized by eminent ophthalmologists the world over as the treatment per se. However, this therapeutic agent is not to be regarded with enthusiasm for, in general, its use must be long continued and the result obtained is often uncertain. It has been my good fortune through association to profit by the experience of a man 40 years in the practice of ophthalmology, a man who was the first to use tuberculin in the city of St. Paul. He has employed it continuously to date.

In discussing the value of tuberculin with him recently we summarized our conclusions as follows:

(1) In the treatment of ocular tuberculosis with tuberculin, some cases are markedly improved, some cases moderately improved, some cases made decidedly worse.

(2) Treatment with tuberculin does not prevent relapses.

(3) Those cases of ocular tuberculosis that respond best to tuberculin are those of nodular iritis unaccompanied by secondary glaucoma or fundal changes.

(4) Given two cases of ocular tuberculosis presenting a striking similarity in clinical appearance and severity, one may show marked improvement under therapeutic doses of tuberculin, the other became worse. One never knows before hand.

(5) Tuberculin as a curative agent should not be used in children; their natural resistance is such that tuberculin is unnecessary. In the aged tuberculin should be contraindicated; their resistance is poor; they do not tolerate it well.

(6) In the use of tuberculin as a therapeutic agent the attempt to establish a routine, graduated dosage administered at certain fixed intervals is folly. Each patient is an individual study and must be administered to accordingly.

(7) To prove an ocular disease tuberculous one must not only produce with a diagnostic dose of tuberculin a local and a general reaction but also a focal reaction.

DR. C. N. SPRATT, Minneapolis: I would like to speak on one phase of tuberculosis of the eye, namely, scleritis and sclero-keratitis. In the autumn of 1905, I had the opportunity of seeing some of the experimental work on rabbits by Stock of Frieberg and later on returning to this country had an opportunity of seeing Verhoff of Boston who was one of the pioneers in working out the relationship of tuberculosis and scleritis. Dr. Berrisford has mentioned the fact that Dr. Boeckmann for years had been calling attention to this but I believe that he did not publish anything. In 1906, I read a paper before this society where I reported a number of cases of sclero-keratitis treated with tuberculin. I then thought as Dr. Verhoff did that we got better results with doses of sufficient size to produce small reactions. I received quite a jar on reading Dr. Verhoff's discussion of Week's paper before the American Ophthalmological Society in June, 1918, in which Verhoff states that his views have entirely changed and he does not rely upon tuberculin as a remedy, but now believes that hygienic measures are of more benefit. There is no question that tuberculin must be used with extreme care.

Within the past year, I have had a man with a mild form of scleritis; developed lung complications with a diagnostic dose of three milligrams of Old Tuberculin.

DR. WILLIAM BENEDICT, Rochester: I think it is well to call the attention of any group of medical

men to the ocular phase of tuberculosis. Dr. Burch has covered the ground well. I am glad he did not emphasize treatment with tuberculin, because we are all disappointed with the tuberculin treatment in ocular tuberculosis.

The diagnosis of tuberculosis of the eye in many instances is anything but clear. Some cases of iritis which closely resemble tuberculosis have been demonstrated in the laboratory to be due to certain types of focal infection. Phlyctenulosis of the eye has been studied by parasitologists, particularly by Luna, who believes that it is caused by pediculosis capitis. Cases of tuberculosis of the eye are not due to the invasion of the tissues by tubercle bacilli but are due to secondary changes from the presence of tubercle bacilli in other parts of the body. We have tuberculids of the eye which are similar to tuberculids of other parts of the body and which are not cleared up by tuberculin but are made worse. On the other hand, they are rapidly cleared up by salvarsan. The corneal opacities will disappear just as tuberculids of the skin will disappear under salvarsan treatment.

DR. F. E. BURCH, St. Paul, (closing): I am very glad to bring out this discussion. We are grateful to Dr. Berrisford for giving us Dr. Boeckmann's experience with tuberculin.

There is one thing about tuberculin that we do not know much about and that is the dosage. Also sometimes a patient getting old tuberculin when changed to new seems to make better progress. One case which we treated for a long time with new tuberculin made very little progress until we changed to the old. At the suggestion of Dr. Longstreet Taylor, in one case reported, Von Ruck's serum was used and a change in the patient's condition was manifested very soon. These varying results with different tuberculins may be merely a coincidence or may be due to a lack of understanding of the therapeutics of tuberculin.

One thing about the prevention of recurrences. I think the whole theory of giving tuberculin therapeutically after having given a diagnostic dose, is an immunological problem. If we are going to get any benefit, if we are going to prevent recurrences in these cases, and they are remarkably prone to recurrences, it is by establishing immunity through the aid of very small doses of tuberculin. I thoroughly believe in that and I believe any patient who is cured should continue to get tuberculin injections purely for immunological purposes.

## METHODS OF MEETING THE SO-CALLED SHORTCOMINGS OF LOCAL ANESTHESIA\*

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In discussing this subject, the real as well as the imaginary shortcomings of local anesthesia must be considered. That this method like all others has real shortcomings, is admitted. However, there are unfortunately charged against the method, some imaginary shortcomings, and there are also border-line points which may be said to lie on one side or the other, depending upon one's point of view. In this communication, it is the writer's purpose to discuss a number of so-called shortcomings of local anesthesia, in an effort to differentiate the imaginary from the real on the one hand, and on the other, to discuss methods by which some of the real shortcomings may be met.

One of the objections most frequently offered to the use of local anesthesia, relates to the psychic effects of an operation performed upon a conscious patient. That this objection is founded to a certain extent upon fact, can not be gainsaid. However, its degree differs with different individuals, and is dependent upon factors, some of which are not under control and therefore can not be eliminated, but as well upon other factors, which are largely under the control of the surgeon. Fortunately, the latter outweigh the former to such an extent, that it would seem to the writer that it is only a question of time when the results of the proper exhibition of the use of local anesthesia will become sufficiently widely disseminated through the minds of the laity, so that many of the factors which are now considered as shortcomings, will be enlisted in the category of advantages. We shall perhaps, always find an occasional individual who will unreasoningly demand that surgical operations of any nature be performed under general narcosis. We shall, probably, also always find an occasional individual who while conscious, can not retain his self control while undergoing a surgical operation of any nature. Another class, of which the thyroid toxicoses is an exam-

\*Read before the Minnesota State Medical Association, St. Paul, October, 1920.



ple, may prove to be more safely handled under some form of general anesthesia on account of the psychic disturbances which any excitement is prone to produce in these cases. Eliminating these, we may ask the question—upon what is the psychic incompatability to local anesthesia founded? An analysis of this subject based upon fifteen years of painstaking investigation, leads me to the conclusion that the objections of patients to undergoing operations under local anesthesia are based on premises which in the main are false. The precedence of general over practical local anesthesia of approximately sixty years, quite naturally places local anesthesia in a secondary position in the lay mind. Added to this, we have the attitude of the majority of the leading surgeons of the world which is decidedly unfavorable to the method, and we also have to contend with the lamentable fact, that so large a percentage of operations performed under local anesthesia are done under a technic which leaves the patient no choice but to become an active anti-local propagandist. When those who essay to perform operations under local anesthesia so perfect their technic, that the reverse of this becomes the rule, rather than the exception, and when surgeons and patients in general begin to reflect with more universal accord the best fruit of the method psychic incompatability,—so-called, will largely disappear as one of the shortcomings of local anesthesia, and greater knowledge will really be an advantage.

*Mixed Anesthesia:* Local anesthesia like all other things, has its limits. The fact that certain operations can not be performed under its influence exclusively, or the fact that portions of certain operations demand general narcosis, should not be looked upon as a shortcoming of the method. An attempt to do the impossible, with the inevitable result—failure—should be looked upon rather as a shortcoming of the surgeon. A large variety of procedures may be begun and finished under the use of local anesthesia, with the utmost satisfaction, although some portion of the procedure may demand general narcosis. Fortunately, there is not the slightest incompatability between local and general anesthesia, and indeed, ether is said to be antidotal to novocain. This gives the surgeon the opportunity of performing the first stages

of an operation under local, obtaining a general survey of conditions, especially in abdominal work, and employing general narcosis should it become necessary, only during that portion of the operation which can not be painlessly carried out under local, and completing the operation as a rule, with a conscious patient. This method has the great advantage of being the means of developing an ability on the part of the surgeon to meet many of the so-called shortcomings of local anesthesia, and its conscientious use will, to a surprising extent, enlarge the scope of local anesthesia in the hands of any surgeon. In my own work for instance, a variety of conditions are now handled under the local method almost as a matter of routine, which but a few years ago I placed in the "impossible" class.

*Abdominal Explorations:* One of the so-called shortcomings of local anesthesia in abdominal work is, that under its use, explorations of the general abdominal cavity are impossible. That this is true to a certain extent must be admitted, and yet, admitting that this is a shortcoming, is it entirely without virtue? And is the routine general abdominal exploration an ideal and universally desirable procedure? How often do we see the upper abdomen explored during the performance of a pelvic laparotomy, and the kidneys, gall bladder and stomach reported normal after a cursory examination with the gloved hand, while the same surgeon after opening the upper abdomen of the next patient, spends many minutes in examining the gall bladder and stomach, perhaps opening the latter in search of an ulcer, and finally depends upon the pathologist for the settlement of a question so blithely decided in the case of patient number one. While I would not decry the use of the blind abdominal exploration to a limited extent, where it is strictly indicated, I think it is as used today too frequently a subterfuge for an incomplete diagnosis. Pelvic pathology, although it may defy an exact diagnosis, should usually be recognized sufficiently from the history, combined with vaginal and rectal examination, to allow one to decide upon the necessity of an operation being performed. In the vast majority of cases, upper abdominal pathology which can be diagnosed by the gloved hand of the operator, will have the classical ear-marks



recorded in a properly written history, a thorough examination plus properly co-ordinated laboratory data. The same is true of lesions of the kidney.

Assuming the truth of the above statements, the question becomes largely one of accurate diagnosis and properly placed incisions. The appendix may be reached from the lower abdominal incision when working under local anesthesia. When the upper abdomen and appendix are under suspicion, the incision may be so placed that the required surgical work may be carried out. During pelvic operations the appendix may be removed without difficulty.

Looking at the subject from this standpoint, this objection to local anesthesia is, it seems to me, not so great as some surgeons would have us believe, for, after all is said and done, it must be admitted that the ideal method of examination is and always must remain the method of direct vision. With a properly prepared abdomen, and a perfect local anesthesia, one may in most cases examine the anterior surface of the stomach, and note the condition of the gall bladder through the pelvic incision by the use of vertical retraction and forced inspiration. Conversely, the pelvic organs may be seen in many instances through the incision in the upper abdomen. We have frequently visualized the stomach, gall bladder and pelvic organs through the gridiron incision for the removal of the appendix. Incidentally, the fact must not be lost sight of that the hand may be introduced into the abdomen of the conscious patient, and digital examination carried out in many instances without marked distress.

**Nausea and Vomiting.** The most objectionable feature encountered in abdominal work under local anesthesia is nausea and vomiting. Usually vomiting is brought about by traction upon some viscus. But here again we know that traction upon the abdominal viscera is one of the most potent shock producers, and it should therefore be eliminated if possible. Under local anesthesia it *must* be eliminated. Whether this is an unalloyed shortcoming, or a virtue, remains to be seen. In work upon the gall bladder, the liver can not be forcefully extracted from the abdominal cavity and laid upon the chest wall. Even under general narcosis this procedure is resented to a marked degree by the

human organism, and in terms which the observing surgeon may easily interpret. By strategy much the same result may be accomplished by carefully "upending" the liver *within* the abdominal cavity, thus rotating it while the gall bladder is projected outward by the inspiratory effort of the patient, and retained in this position. (Fig. No. 1).

All work in the upper abdomen should be preceded if possible by the blocking of the splanchnic system, and one should not hesitate to give general anesthesia in any case which can not be satisfactorily handled under local. Stomach surgery demands the avoidance of traction, and should be done insofar as it is possible, without the use of clamps. The patient can as a rule place the stomach in a favorable position, provided the incision is properly placed. In doing a gastroenterostomy, for instance, it is not necessary to place the hand in the lesser peritoneal cavity and dislocate the stomach in order to force it through the rent in the colic mesentery. A small clip placed at the proper point upon the greater curvature, serves to identify the future anastomotic point, and by its use, the stomach may be "fed" through beneath the colon.

Viscero-parietal adhesions, while considered an obstacle to the use of local anesthesia, are really very satisfactorily dealt with by making use of a negative intra-abdominal pressure and vertical retraction. (Fig. No. 2). Adherent pathology which is beyond the scope of local anesthesia, should at once be relegated to the general narcosis class.

**Caudal Anesthesia.** The use of caudal anesthesia as an adjunct to local anesthesia in surgery of the pelvis, is worthy I believe, of a more extensive trial. We have under its influence, found the pelvic organs entirely insensitive, and allowing the performance of the most extensive procedures, with the greatest satisfaction. Unfortunately, the anesthesia is not constant in its effects, and in attempting its use, about 10 per cent of failures are reported. Also, toxic symptoms seem to be not uncommon, although they are of mild degree. Should further experience render this form of anesthesia certain and constant, it should prove the anesthesia of choice for pelvic work. In prostatic surgery, caudal anesthesia, combined with suprapubic infiltra-



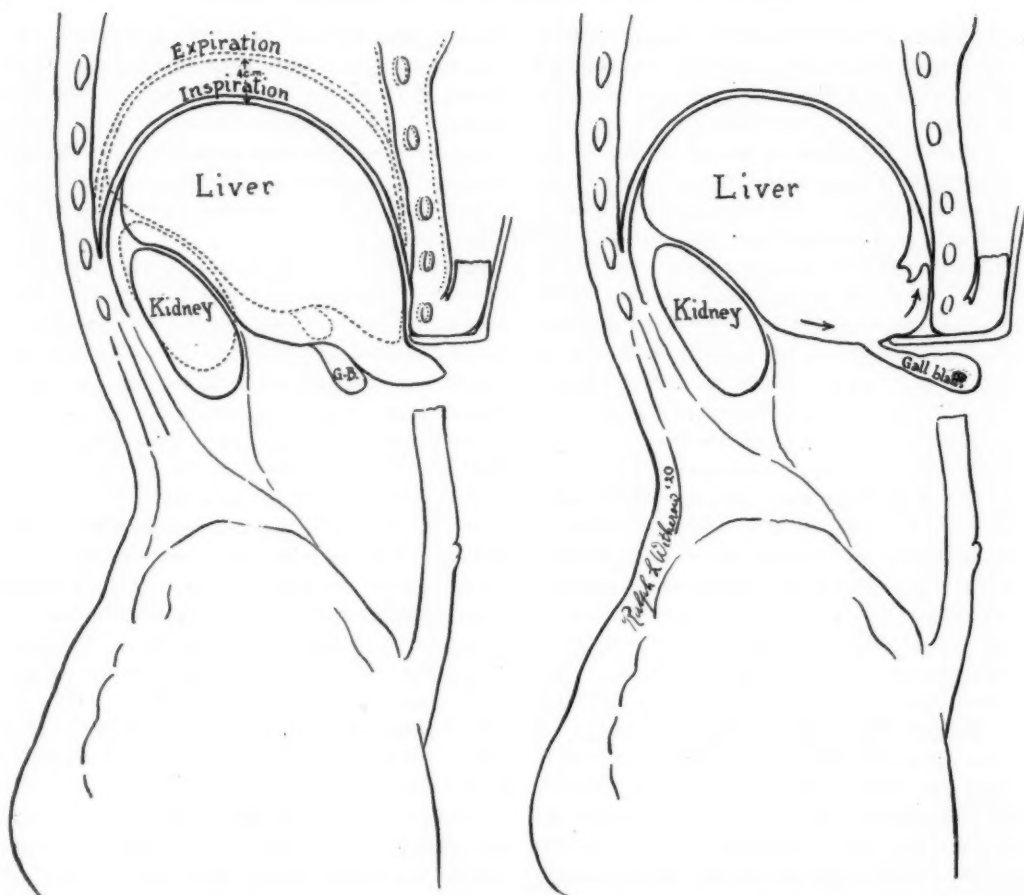


Fig. 1. Method of rotating liver within abdomen for exposure of gall-bladder and ducts.

tion, gives one practically 100 per cent perfection. In our last ten cases, the anesthesia was ideal in every instance, and the pulse rate at the end of the operation averaged 75.

**Hardship to the Surgeon.** Another of the so-called disadvantages of local anesthesia, is the hardship imposed upon the surgeon who uses it. The facts are, that it is a much more simple matter, and less wearing upon the surgeon, to operate upon a patient who is deeply narcotized, because many annoying details are eliminated and do not have to be considered. It is not necessary to introduce the anesthetic, necessary and even unnecessary trauma are not resented by the patient, the mastery of a refined technic is not so essential, and the necessity of learning a new or unusual system of procedure is eliminated. In other words, the lines of least resistance

are more readily followed here, as they are in all other fields of endeavor. And yet, provided we take as our standard the maximum benefit to the patient, can we with justice, consider, this point alone as a shortcoming of any method? The same argument applies with equal strength to the development of an aseptic technic, a high degree of efficiency in the nursing staff, or a high degree of development in the diagnostic department of one's clinic. The approach to the ideal is always fraught with hardships to the surgeon. They are entirely relative, and the whole question relates to, whether or not they are worth while, and this point must it seems to me, be made the crux when considering pro and con the hardship to the surgeon.

In considering this hardship to the surgeon, it may be well to reflect upon the fact that the

use of methods to which we are not thoroughly accustomed, and which are not used routinely, always demand a greater outlay of energy, and that practice in the use of these methods brings with it a great reduction in the difficulties to be overcome, and a consequent decrease in the amount of energy necessarily expended.

*Division of Attention.* Many surgeons object to local anesthesia because of the fact that the conscious patient demands, or seems to demand, a certain proportion of their attention, whereas, in the fully narcotized patient, the whole attention may be given to the surgical work. Provided this is to be considered a shortcoming of the method, one must consider all other features which may in any way detract the surgeon's attention from the operation, such as demonstrations of the work being done to visiting physicians, nurses and students, as well as the distraction which is, or always should be present in the mind of the surgeon during the time in which the patient is inhaling general anesthesia. In my experience, a poorly administered general anesthetic, or one that is for any reason unsatisfactory, is far more annoying and more apt to

interfere with the performance of a surgical operation, than is the division of attention found necessary when local anesthesia is used, and I believe that it is less difficult to acquire the habit of dividing attention when local anesthesia is used, than it is to demonstrate to an audience while operating. As a matter of fact, in each instance, a certain amount of training is required, and with most individuals who are competent to do surgery, the method soon becomes automatic. The elimination of the worries over the shortcomings of general narcosis, the realization of the safety of local anesthesia, and the opportunity it gives one to do a more refined grade of surgery, with the additional manifest advantage to the patient easily converts this so-called shortcoming of local anesthesia into an advantage.

*Time.* The element of time may in some cases be worth considering, although, with the benefit to the patient being considered of paramount importance, the time element must be looked upon as more or less insignificant. As a matter of fact, with proper technic and proper equipment, a large percentage of operations may be

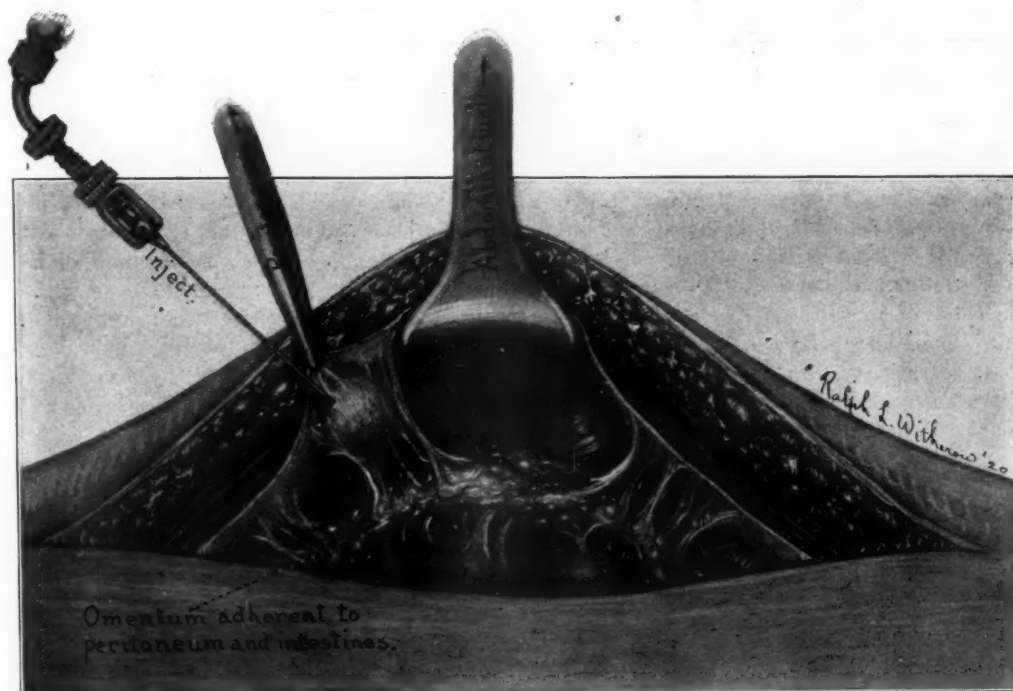


Fig. II. Vertical retraction showing method of handling Viscero Parietal Adhesions under Local Anesthesia.

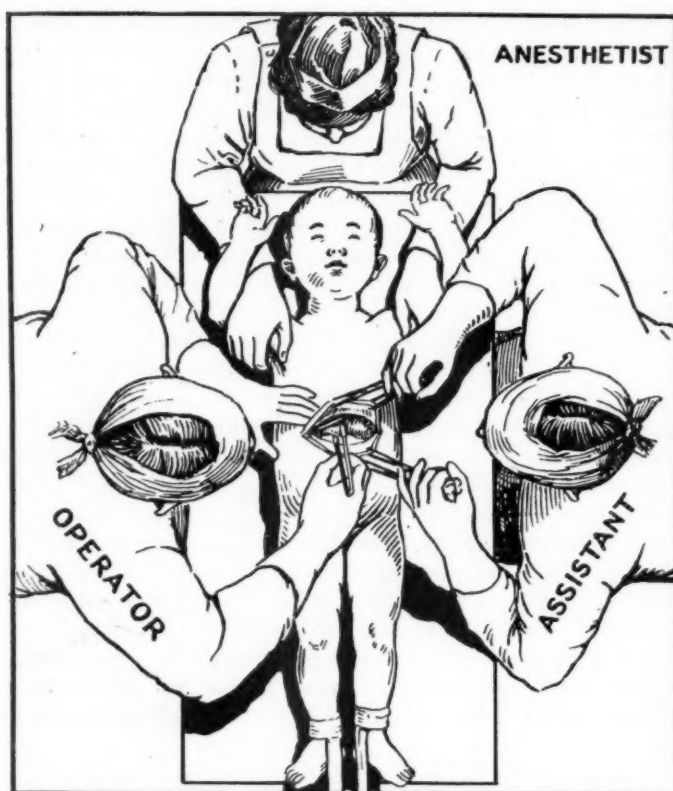


Fig. III. Illustrating the method of controlling young children in operations under local anesthesia. By making traction on the arms, the anesthetist controls the child when necessary.

performed in almost the same time under local as where general anesthesia is used. While the actual performance of an operation may require a somewhat longer time, the combined time of the introduction of the anesthetic, and the performance of an operation, is but slightly different. Local anesthesia can be administered for most operations in less than five minutes, and frequently, only two minutes are required. It is simply a matter of proper equipment and the proper technic. With the pneumatic injector and the direct infiltration, or what I have chosen to call "infiltration-block", the element of time should no longer be considered as a serious shortcoming of local anesthesia.

**Children.** Childhood is commonly accepted as a contraindication for local anesthesia, and most authorities agree that the method has no application to this class of patients. I have found on the contrary, that local anesthesia

presents some of its greatest advantages in the surgery of children. The so-called psychoic manifestations are not to be compared with those manifested when general narcosis is used, and in a comparatively large percentage of children requiring surgery, general anesthesia is a positive menace to life I refer especially to empyema, intestinal obstruction, hypertrophic pyloric stenosis, etc.

In abdominal work, where local anesthesia is generally thought to be contraindicated, we have found its most satisfactory application. Restraint is required in all cases, but that required during the induction of general narcosis. The method illustrated (Fig. 3), shows a satisfactory means of restraining children while the anesthetic is being introduced. With this method a sterile field may be maintained, as the breaking up of an aseptic technic is the greatest difficulty with which we have to contend.

**Wound Healing.** The interference with wound healing when local anesthesia is used, is mentioned simply because it appears in the literature as one of the shortcomings of local anesthesia. The facts are, that novocain dissolved in Ringer's Solution, and properly sterilized, has not the slightest effect upon wound healing. The fluid introduced is absorbed, and the drug itself is absolutely inert so far as its effect on the tissue cells is concerned.

**Necrosis.** Necrosis of the tissues is reported occasionally in the literature. This should not be charged to local anesthesia when it occurs. It is due to too great concentration of the adrenalin solution, combined with too forceful injection into the skin. It is simply an evidence of an improper use of the method.

**After Pain.** Some objectors claim that the amount of after pain is comparatively greater where local anesthesia is used. That this is not

the case has been quite definitely proved by a series of experiments carried on upon living subjects. In bilateral operations where general anesthesia was used, novocain was injected in one wound, while none was used on the opposite side. In no instance was there any difference in the amount of pain complained of. I believe the misconception regarding after pain being greater originated in this way. The patient operated upon under local anesthesia naturally complains more bitterly of pain directly after an operation than does the semi-conscious individual whose nausea and vomiting serve to distract his attention from the seat of operation. The general impression formed by some surgeons that their patients who have been operated upon under local anesthesia have more pain than their other patients can not be taken too seriously on account of the great variation we find in individuals and also because the judgments of surgeons in matters of this kind admits of great possibility of error.

*Conclusions.* In conclusion, let me state that my experience leads me to believe that many of the so-called shortcomings of local anesthesia are more imaginary than real.

That more careful attention to the facts, especially by those of large surgical experience, will eliminate many of the fallacies now extant regarding this art.

And, that training and experience, when sufficiently disseminated, will convert most of the so-called shortcomings into advantage and develop strategic methods of meeting many of the real shortcomings which today confront us.

Discussion appears on page 220.

## THE PRESENT CONCEPT OF LOCAL ANESTHESIA TECHNIQUE\*

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In the selection of a local anesthetic one must be governed by its efficiency and its toxicity. Cocain is generally accepted as the most efficient drug but it is also the most toxic. Novocain is but slightly less efficient than cocain and when properly administered is practically without

danger. In the order of their toxicity the drugs in common use are: Cocain, beta eucain, alypin, stovain, tropococain, novocain. Quinine and urea has not proved highly satisfactory because of its slow action and its slightly painful introduction. Its greatest field of usefulness lies in the prevention of pain following surgical operations, particularly those on the throat and rectum. In solutions stronger than 1-6 per cent, it frequently interferes with primary healing. Saligenin, a discovery of Dr. Hirschfelder of the University of Minnesota, is now being tested out and because of its low toxicity has great possibilities. Aposthesine<sup>7</sup> has recently been reported by the National Council of Pharmacy as only slightly less toxic than cocain and less efficient than novocain. Novocain because it is efficient and because it may be used almost ad libitum must be accepted as the local anesthetic of choice.

The toxicity of this type of drugs depends upon the amount absorbed directly into the circulation. Experimentally it is stated that the lethal dose of cocain, (and that applies generally to this group of drugs) is smallest intravenously, 8 to 10 times greater intraarterially and more than 30 times greater subcutaneously. By introducing a weak solution slowly, intermittently or by controlling its absorption, many times the toxic dose may be given with perfect safety. That concentrated solutions are many times more toxic than weak solutions was demonstrated by Schleich and Reclus. To produce satisfactory anesthesia in major surgery it is absolutely imperative that large quantities be used. Allan reports the use of 38.4 grains with out harmful results, while Babcock has used 12 ounces of 1 per cent (equivalent to 60 grains) and the author has personally seen 19 ounces of 1/2 per cent (equivalent to 45 grains) used by Farr with no untoward symptoms.

The control of absorption besides influencing the toxicity also determines to a large extent the duration of the anesthesia. This may be accomplished by the addition of adrenalin or the use of a tourniquet. Adrenalin also has the distinct advantage of rendering the operative field bloodless. Caution should always be exercised not to use adrenalin in the presence of a terminal circulation such as the finger or the penis because of the danger of gangrene.

\*Read before the Minnesota State Medical Association, St. Paul, October, 1920.



The most simple method of producing local anesthesia is the infiltration or the odematization of the tissues in and about the site of the operation. However, in many cases, regional methods are to be preferred. By the regional methods, the nerves are blocked proximally to the site of the operation and this is necessarily a more difficult procedure, demanding a thorough knowledge of the nerve supply to the operative field.

Regional anesthesia or nerve blocking includes the following methods: (1) intraneural injections, (2) paraneural injections, (3) spinal analgesia, (4) intravenous injections, (5) intraarterial injections, (6) circumferential infiltration of Hackenbruch, (7) caudal anesthesia.

The paraneural or infiltration block, and the circumferential infiltration of Hackenbruch, are the simplest and the most commonly used. The others are more dangerous and require a certain technique which renders them more difficult. Because they possess no particular advantage I shall not discuss the spinal, intravenous or intraarterial methods.

#### TECHNIQUE

The primary requisite is a number of good syringes preferably of glass or metal that will not leak even under high pressure, together with an assortment of needles, varying from 1 to 4 inches long and in calibre from 18 to 24, which will not become detached during use. The self filling syringes and the Farr Pneumatic Injector possess great advantage over the ordinary syringes and render the injection more simple and more rapid.

For infiltration, infiltration block (paraneural) and caudal anesthesia 5-10 to 7-10 per cent novocain in Ringer's solution (with 3 to 5 minims of adrenalin 1-1000 to the ounce) has proved most satisfactory in our hands, while for intraneural injections we prefer 1 to 2 per cent novocain in Ringer's solution with the same proportions of adrenalin.

#### PRELIMINARY PREPARATION

The preliminary preparation of the patient consists to a large extent of an endeavor to keep him in a good mental state. The patient who enters the hospital the night before is generally given a light supper, and a sufficient amount of sedative to insure him a good night's rest; he

is usually given an enema, but is not purged. He may be shaved and prepared, but not in a brilliantly lighted operating room, which usually causes fright. Hypodermics of morphine and scopolomine may be given preliminary to the operation if nereo-local anesthesia is desired. He is then quietly transported to the operating room with eyes covered, and placed on an operating table with soft pillows, paying particular attention to the comfortable position of the arms and legs. During the operation he is permitted water in small amounts, while candy, milk or a nipple may be given to children and infants. Music is helpful in maintaining a state of mental composure.

#### INFILTRATION ANESTHESIA

After first warning the patient, a very fine needle is introduced and a wheal made in the skin. A second needle of slightly larger calibre 2.5 to 3 inches long is introduced through this wheal into the subcutaneous tissues injecting continuously as the needle advances. It is then run along subcutaneously for 2.5 inches where a second wheal is made in the skin but this time from beneath. Through the second dermal wheal the needle may be introduced painlessly at once. By then introducing the needle vertically through the anesthetized skin, the deeper layers may be infiltrated in the same manner until all the tissues through which the incision is to be made have been odematized. or the ordinary mid-line incision the injection has been made and the abdomen opened painlessly in six minutes.

A most important point in the technique little emphasized, is to always inject with the needle advancing or during its withdrawal but never with the point stationary, because of the danger of an intravenous dose. By keeping the needle moving the necessity for aspiration is eliminated. The infiltration method lends itself particularly to operations upon the abdominal wall. However, because of certain anatomic advantages or the disadvantage of odematous tissues, regional anesthesia may be preferred or a combination of some form of regional and infiltration may be used.

#### INTRA NEURAL INJECTION

One of the best examples of this method is the brachial anesthesia of Kulenkampff. A wheal is made in the skin over the mid point of



the clavicle. With the finger over the subclavian artery, a long fine needle is introduced through the wheal downward, inward and backward, pointing in the direction of the second dorsal spine. Sensation referred to the little and ring fingers indicates the point for injection. Ten c. c. of a 1 or 2 per cent novocain solution is usually sufficient for complete anesthesia of the whole arm. The needle should be introduced unattached to the syringe or if attached aspiration should be attempted to again avoid an intravenous dose. The main objections to this method are that it is not absolutely free from danger and is technically difficult.

#### PARA NEURAL INJECTION OR INFILTRATION BLOCK

By this method the tissues *about* the nerve trunks are edematized. It is a much more simple procedure and very effective, especially when reenforced by subdermal infiltration at the site of incision. By the combined methods the cervical nerves may be anesthetized at their exit by infiltration block, reenforced by subdermal infiltration at the site of operation permitting bloc dissection of the neck, thyroidectomies, laryngectomies, and so forth, to be done without pain. An infiltration block of the cervicals, together with the upper six thoracic nerves reenforced by subdermal infiltration will permit radical amputation of the breast with dissection of the axilla to be done very satisfactorily. The combined method is also ideal in inguinal hernia, where edematized tissue may interfere with their identification. Here an infiltration is made under the skin along the line of the incision and the ilio-inguinal and iliohypogastric nerves are blocked under the external oblique fascia near the anterior superior spine. The genital branch of the genito-crural nerve is blocked after exposure of the cord.

#### CIRCUMFERENTIAL INFILTRATION OF HACKENBRUCH

By this method the site of operation is circumscribed, blocking the nerves proximally. Almost all texts on local anesthesia recommend the making of several wheals in the skin which are connected subcutaneously. This technique may be greatly improved by making all except the first wheal from beneath and painlessly as described under infiltration anesthesia. Repeated small pricks in the making of skin wheals

frequently forfeits the patients confidence and spells failure for the method.

#### CAUDAL ANESTHESIA

By this method a fairly large needle with obturator is introduced through the terminal sacral canal. The obturator is removed and about 4 ounces of novocain 0.5 per cent with adrenalin are injected. The injection is extradural, the fluid finding its way along the line of cleavage between the dura and spine, bathing the nerves at their exit. The terminal spinal nerves are the ones especially effected but the author has observed anesthesia as high as the nipples. The method has great possibilities but in our experience has not been without untoward symptoms, a fall of blood pressure, sudden paling, and acceleration of the pulse having been observed. The same precautions against intravenous administration must be exercised as in brachial anesthesia. The anesthesia is ideal, permitting any work in the perineum and rectum to be performed and serves as a valuable adjunct in the performance of operations in the pelvis.

#### TRANSVERSE BLOCK OF THE EXTREMITIES

In the case of the extremities a subdermal infiltration<sup>6</sup> may be made completely around the limb. Through this anesthetized ring the needle is introduced at right angles forming a transverse plane of infiltration completely through the extremity, depositing most of the solution in the neighborhood of large nerve trunks. The anesthesia is equally applicable to arm or leg and is complete and safe. It is surely a much safer procedure for the doctor who alone must amputate or reduce a fracture, and give the anesthetic at the same time, in such an unfavorable location as a farm house or in his office. The injection of the anesthetic may be accomplished in from 8 to 10 minutes with a good syringe, following which the surgeon may devote his undivided attention to the operation.

#### LOCAL ANESTHESIA IN ABDOMINAL OPERATIONS

When the anesthesia of the abdominal wall has been complete and the incision entirely painless there will be encountered a negative pressure, an inrush of air, and a falling away of the abdominal contents. This is the ideal to be attained as for instance in a pelvic case without adhesions, in the Trendelenberg position, all intestines will be found in the upper abdomen

and no packs will be needed. Lifting vertically the abdominal wall permits exploration visually of practically any part of the abdomen. We have repeatedly examined both visually and by palpitation the stomach and gall bladder through a lower abdominal incision and the appendix and pelvis through an upper abdominal incision. Tilting the table laterally aids greatly in exposing the organs on one side or the other, similar to the effect produced by the Trendelenberg position.

Adhesions to the parietal peritoneum are very easily cared for under local anesthesia. The abdominal wall is elevated, putting the adhesions on tension so that they may be divided by knife dissection along the white lines, without hemorrhage. Pain is prevented by the injection of the parietal peritonium.

In abdominal surgery under local anesthesia, one must constantly bear in mind certain painful points that must be anesthetized, such as the round and broad ligaments, the ovarian pedicle, the meso-appendix, the mesentery, and the tissues of and about the bile ducts. These should be infiltrated before any attempt is made to handle them. The utmost care must be exercised at all times, which reduces trauma to a minimum and teaches the surgeon the wholesome respect for tissues the final results of which are less post operative vomiting, fewer gas pains and a generally less stormy convalescence.

#### BIBLIOGRAPHY

1. Report of National Council of Pharmacy—Journal American Medical Association, January 24, 1920, Page 266.
2. Oppen, V., quoted by Allen "Local Anaesthesia", Page 124.
3. Allen, Carroll—Local Anaesthesia, Page 125.
4. Farr, R. E.—"Abdominal Surgery Under Local Anaesthesia", Journal Lancet, June 1, 1917.
5. Sturmdorf, Arnold — Gyno-plastic Operations, Page 19.
6. Dunn, Sherwood — Regional Anaesthesia, Page 227.

Discussion appears on page 220.

#### PRESENT STATUS OF THE LOCAL ANESTHESIA PROBLEM\*

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It is the object of this paper to present a few facts relative to the present status of the local anesthesia problem, as compared to general anesthesia. At the present time there is no ideal anesthesia. The lightest anesthetic that is consistent with the best work is the safest.

There are at present no statistics available as to death rate under local anesthesia. Occasionally a case is reported, as death from local anesthesia, from apparently non-toxic substances, such as novocain. Every person knows or should know the toxicity of cocaine, and that it is about as dangerous an anesthetic as could be used in major surgery. A number of deaths have been reported from comparatively minor operations. The death rate from general anesthesia, under ether, has been stated to be 1-10,000, under chloroform 1-3,000, and under gas-oxygen about the same as chloroform, when given by a skilled anesthetist. Statistics recently collected, by Salzer and Stewart give the mortality rate from general anesthesia at 1-600, and I doubt not, but that it is even greater than this, except in well organized clinics, where trained anesthetists are available.

Morris has shown that tests for acetone bodies are present in the urine after ether anesthesia has been administered. With lowered carbon dioxide combining power of blood, there is an increased retention of nitrogen in the blood. It is a well known fact, that, where the carbon dioxide combining power of blood in diabetics is lowered, there is an increased formation or retention of blood sugar. In a series of cases, Short shows the carbon dioxide combining power of the blood to be decreased 4 to 17 per cent under ether, the anesthetic varying in duration from 26 to 70 minutes. The drop is greater from chloroform. Killian has shown that the drop is much less under spinal or gas-oxygen anesthesia. The fact that the mortality rate in surgical diabetics has been reduced from 6 per cent under general to 3+ per cent under local anesthesia, speaks for itself. Another factor

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that we must remember is that local anesthesia is resorted to, by the majority of surgeons, only in exceptional cases i. e., diabetes, senility, pulmonary, cardiac or renal complications, rather than as a routine measure.

Preventable deaths from anesthesia may be divided into three groups; (1) those resulting from the anesthetic itself, (2) faulty administration, (3) pathologic and physiologic causes in the patient. Some drugs used for local anesthetics are practically non-toxic, for example novocain and saligenin. Yet there are a few, as will be mentioned by Dr. Maxeiner, that should not be used for major work. Faulty hospital system, or none at all, in regard to the general anesthetic problem, combined with disregard in most of our medical schools for the teaching of one of our most important sciences, is the cause for the second. At the present time, there is only one class. A medical school that has a professor of anesthesia. In a few eastern cities, the hospitals have recognized this failure, and have consultant anesthetists on their staff. These cities have organized societies and associations of anesthetists. Reliable statistics will be ready in the course of a few years. As regards the administration of local anesthesia, it is done, on the whole, with more precision and knowledge on the part of the anesthetist, yet we see attempts at producing local anesthesia, which cannot but result in failure. And even with failure apparent, the surgeon does not use combined anesthesia, but continues to perform the work, subjecting the patient to pain and shock, just as severe or more severe than would have resulted, had a general anesthetic been administered primarily. General anesthesia may be the choice in well organized clinics, where trained anesthetists are available, where functional state, i. e., cardiac reserve, renal function, metabolism and so forth, has been well determined. It is not the well organized clinics that have a high death rate from anesthesia, but it is in the smaller cities, rural districts or the hospitals, where the system is at fault and no trained anesthetists is available.

There are a few requirements necessary to the successful performance of the work.

1. Careful attention to essential details. These can be learned from any text book, but

unless known, will mean failure the first time and "as a rule not a second attempt."

2. Less manipulation of the tissues and this means better technique. Exploration is made more by visual examination, than by digital. If digital examination is necessary, combined anesthesia may be used, provided it cannot successfully be made under local. This does not require the stage of surgical anesthesia, but the stage of analgesia is sufficient. The surgeon should know the limitations and not subject any patient to pain, for shock can be produced from pain in this manner, just as easily as from any added trauma or anesthesia.

3. Cooperation of the patient and surgeon, combined with preoperative cooperation of nurses and attendants. Suggestive remarks at time of admittance may destroy the confidence of the patient. This applies equally well to any procedure that transpires in the surgical amphitheatre. Suggestive remarks by attendants or friends such as "are you having pain," creates an impression which may lead to loss of mental control.

4. In regional blocking knowledge of anatomy is essential.

5. In abdominal work, vertical retraction combined with a position of patient so as to get negative abdominal pressure so essential to a successful visual examination, should be used. Digital examination can be made, provided no tension or traction is made upon mesentery. The visceral peritoneum is not sensitive to pain, as far as we know, except in acute or subacute inflammatory conditions, but any manipulation of the parietal peritoneum will cause pain. The parietal peritoneum is very sensitive. Packing can be used if properly performed, but in a majority of cases, it is only necessary to prevent soiling of the field.

There are disadvantages which we hope will be met, as our knowledge of this subject increases. Psychic and time elements will be taken up by Dr. Farr. As to the increased risk of infection, this is still unproved. It is my personal impression that, giving attention to details, there will be no more infections than under general anesthesia. In my service at the General Hospital No. 26, where all wounds with any suspicious looking material were cultured, there was a smaller percentage of infections on my

service, than on any clean service. In these cases either infiltration anesthesia, or local with regional blocking or with gas-oxygen, was used. There was only one pulmonary complication, in a series of about 150 nerve operations. This followed separation of a pedicle flap, three weeks after neurolysis of an ulnar and median nerve injury of the forearm and this complication developed following diphtheria. Disadvantages, such as adhesions in the posterior parietal peritoneum, and malignant conditions in this location, can at times be met successfully. Where this cannot be accomplished, it is much better to give either ether or gas-oxygen combined with local infiltration, provided, it cannot be satisfactorily performed by associated caudal injection. Post-operative local complications which consist of reactionary hemorrhage and serum discharge of the wound, give little or no trouble if all bleeding vessels are tied, and loose suture of wound is practiced. General postoperative conditions such as insomnia and pain are less than under general anesthesia when work is successfully done. When pelvic work has been performed there is retention of urine in a larger number of cases. In absence of infection, distension, nausea, vomiting and ileus do not result nearly so often, providing satisfactory anesthesia has been present and no traction has been made upon mesentery. I rather think that in a number of cases when nausea is present, it is a result of the pre-operative administration of narcotics. If the patient is subjected to pain during operative administration, this will be worse. Jaundice, which is often mentioned, has been noted in comparatively few cases of my own.

A few advantages in regard to surgery of the different parts may be mentioned. With the head and neck, you have the cooperation of the patient in aiding to hold the head in most advantageous position, for the best work. The engorgement of vessels that is so often seen under general anesthesia is not present. Postoperatively, there is not the danger of loosening up dressings from vomiting in straining, and soiling of the wound from vomitus. Nourishment can be taken at once if necessary. I have not yet seen permanent injury of the recurrent laryngeal nerve in a single goitre that has been performed under local anesthesia. With thoracic

surgery, the patient can be given nourishment at once and there is not the danger of stirring up an acute respiratory complication. This may also be stated in regard to an already present pulmonary lesion, in regard to surgery of any part. Abdominal work gives the operator a chance to make a visual examination, and in some obscure pathologic condition, he can, with aid of the patient, locate the exact point of the lesion, by producing the same pain that the patient has been suffering from. Work on the extremities is most satisfactory. Fractures can be reduced either by regional blocking or infiltration blocking. For infections of the hand, it is the ideal anesthetic. The practitioner can carry in a hand bag sufficient material necessary to do work on the extremities such as mentioned. A package consisting of sterilized novocain, needles, syringe and field towels, is sufficient to reduce the average fracture in the country.

#### CONCLUSIONS

1. There are requisites necessary which must be learned before success in this work will be obtained.
2. The subject of anesthesia, local as well as general, should be given more attention in our medical schools.
3. Postoperative complications are fewer, and recovery is better in a shorter length of time.
4. Disadvantages are more unreal than real.
5. The patient aids in preventing any unnecessary trauma.
6. The mortality rate can be reduced as evident by the reduction of the mortality rate in surgical diabetics.
7. And finally upon the enthusiasm of the surgeon and increasing knowledge of the subject, rests the future of local anesthesia and the widening of its field of usefulness.

#### DISCUSSION

(Discussion on papers of Drs. Farr, Bratrud and Maxe'ner)

DR. L. E. DAUGHERTY, St. Paul: We have found a constantly increasing field for the use of local anesthesia. Not only that, we have found that the people are coming to us demanding local anesthesia. Especially is this true of those who have taken a general anesthetic. I think this is due to the educational propaganda carried on by Dr. Farr and his associates and by their work.

There are some things we cannot do under local



anesthesia and some things we do not want to do. For instance, in abdominal work, as Dr. Farr said, when you put traction on the mesentery it invariably produces vomiting and distress.

After local anesthesia, I am convinced that a great amount of postoperative vomiting is due to the narcotic given before the local anesthetic. We have had very little postoperative vomiting due to local anesthetic except in those cases where we have used morphine.

The element of time it seems to me is hardly to be considered. As Dr. Farr said, we can use a local anesthetic and it does not take any more time than a general anesthetic. In a great many cases it does not take as much and if we consider the welfare of the patient as paramount, time should not be considered.

The use of local anesthesia in childhood it seems to me is the crucial test. We have repeatedly operated on children from 4 to 14 years of age under local anesthesia. Following the recent "flu" epidemic when we had so many cases of empyema I have often opened the chest cavity with the child sitting on the edge of the table in cases where we could not give a general anesthetic. The after pain has been less in our experience. We have not had these children complaining of pain after local anesthesia. It seems to me the severest critics of local anesthesia today are those who will not use local anesthesia, or those who cannot use it successfully.

DR. G. L. LABAT, Paris: I was not prepared, of course, to take part in the discussion, but I am very glad to say that I have been invited by Dr. Mayo to attend this most important meeting. I will say just what my experience has taught me in regard to this important subject.

I have heard Dr. Farr and others speak of the general methods, present status and present concept of local anesthesia. Of course, I have nothing to add regarding the technic, nothing to add regarding the psychic element in connection with local anesthesia, except that the psychic element can certainly be done away with by a little scopolamin and morphin. I have just heard about scopolamin and morphin, at least morphin, creating disturbances of nausea and vomiting in the preoperative and postoperative periods. The little experience I have had with scopolamin and morphin has shown that each time we have done away with the psychic element. We give at least an hour before the anesthetic is given a dose of morphin and scopolamin. A small dose acts as an excitant but very often a larger dose acts also as an excitant, but in my opinion I do not think that scopolamin and morphin has anything to do with the vomiting. Certainly in abdominal surgery tractions which are made on the mesentery, and especially in gastric surgery where pressure is made on the cardiac wall of the stomach, have a certain reflex effect on the splanchnic nerve supply and I think that causes the vomiting. While I am on the splanchnic nerve supply I will tell you

the experience we had some time ago in connection with abdominal surgery and splanchnic analgesia. It is, as all you gentlemen know, very difficult to operate on the abdominal organs with local anesthesia, because, as we all know, the parietal peritoneum is very sensitive. Traction on the parietal peritoneum causes a certain disturbance if not a real discomfort. It is the retroperitoneal tissue, chiefly supplied with cerebrospinal nerves that is affected when traction is made on the parietal peritoneum. We have 50 cases of gastro-intestinal surgery operated under local anesthesia. In these cases, after infiltrating the abdominal wall, we infiltrated the splanchnic nerves. At the junction of the splanchnic nerve with the semilunar ganglion the needle was inserted. We brought the needle through from the back on each side of the spine until we reached the retroperitoneal tissue and there we injected a certain quantity of novocain-adrenalin solution, 1 per cent novocain with adrenalin for each 100 c.c. of the solution. In the 50 cases thus infiltrated we obtained 48 good results. The purpose was not to anesthetize the splanchnic nerves, because this, we are of the opinion, can produce certain pathologic conditions of the splanchnic nerves, but to infiltrate the retroperitoneal tissues so as to allow us to make traction on the mesentery and on the stomach without causing any pain to the patient. We succeeded by infiltrating 25 to 30 c.c. of a 1 per cent novocain solution into the retroperitoneal tissues by a special technic, in doing our stomach operations. We have also done gall bladder operations that way. In two instances we injected just at the level of the twelfth rib, four fingers distant from the middle line on the spine, directing the needle at an angle of 45 degrees with the median plane of the body until it reached the body of the first lumbar vertebra and as soon as the needle went on gliding along the body of the vertebra, we went in 1 cm. farther and then injected the solution. Our technic certainly in these two instances must have been at fault because the solution instead of running into the retroperitoneal tissues so as to infiltrate them went somewhere else, with the result that the lower limbs were partly anesthetized. That was at the beginning of our experience. We know now that all operations on the stomach and even, I may say, on the upper abdomen, can be made by regional anesthesia. It is a kind of a paravertebral anesthesia. It is not the regular method; it is a new method we have been trying and have succeeded in using.

DR. GEORGE EARL, St. Paul: I was interested to find out just how much we are using local anesthesia. In 1918 in major abdominal surgery we did one operation out of thirty under local anesthesia. In 1919 the ratio had increased to one in seventeen, and this year, 1920, during the first eight months up to September 1, I find, on going over the statistics at the Mounds Park Sanitarium, that we are doing one in three. In less than three years our ratio has increased from 1 in 30 to 1 in 3. We have

made no insistent effort to use local anesthesia. Often patients decide for themselves. We have come to use local anesthesia because we found no increased infection; the after-effects have been lessened; the recoveries have been more rapid, and in general we have felt there has been less surgical risk.

I think we have all been impressed thru these papers that, after all, it is not the drug that is used—novocain is used because it is less toxic—but it is the effort these men put forth; i. e., the scientific handling of the patient from the time he enters the hospital until the operation. The moral anesthetist that is always present plays an important role in the success of local anesthesia. As to preliminary narcotics, I believe that a good hypnotic might bring the patient to the first stage of a twilight sleep and thus simplify the use of the local anesthetic. We do not approach an operation under local with the feeling that we are going to insist absolutely on its use alone. We tell the patient that if it hurts, we will give him a little gas. A competent anesthetist is always present ready to administer it at a moment's notice. Possibly most men attempt too much to begin with.

In goiter work, our technic consists in infiltrating the line of incision and from this upward a sufficient distance to cover the area that the flap is to be retracted. At the same time the muscles are infiltrated slightly and the incision is immediately made. Usually we can then proceed to the vertical incision over the muscles covering the thyroid, and if necessary, make a lateral incision over the thyroid without further infiltration. The goiter is then exposed. We infiltrate the two superior poles. We have found in most cases that the sensitive point is at the superior poles and the trachea adjacent. By injecting these areas we have succeeded usually in securing a satisfactory anesthesia. I think we have reduced the time for operating in goiter because the tissues are more visible and we are not dealing with a great many problems of general anesthesia. We have not used special vertebral technic in laparotomies either, but have almost entirely confined ourselves to infiltration.

DR. J. A. EVERT, Brainerd: I was very much interested in hearing Dr. Maxeiner say that he is using nerve block anesthesia in the repair of hernia. We have seen in our clinic recently a few recurrent hernias that have been operated on by men in our district with local anesthesia. Due partly I think to Dr. Farr's good work, a great many surgeons have tried to emulate this work in the state and are using infiltration anesthesia especially in the repair of hernias and are getting recurrences. This probably is due to the fact that they are so anxious to handle the tissues gently that they do not do the radical operation the case demands, in many cases not even displacing the cord, and the hernia comes

back. Unless we can do this operation correctly with nerve blocking we should stick to the general anesthetic.

DR. R. E. FARR, Minneapolis (closing): I wish to thank Dr. Labete and the other gentlemen who have discussed the papers.

Dr. Evert states that hernias operated upon under local anesthesia return because surgeons fail to perform these operations properly under this form of anesthesia. I hope that I am no more to blame for some things that I am blamed for, than local anesthesia is to blame for the recurrence of these hernias. We do the Torek operation, which makes it necessary to make a full dissection of the parts, going well into the abdominal cavity. Men who can not produce anesthesia sufficiently satisfactorily for this work should use general anesthesia. They should place the blame where it belongs.

Regarding sedatives, we are still undecided but I believe they are desirable from the psychic standpoint as well as from the standpoint of comfort. Without preliminary hypodermics M. L. Harris has reduced his vomiting to 4 per cent. Our percentage of vomiting is much higher than this, either with or without sedatives. A light Twilight Sleep combined with local anesthesia gives us, I believe, the most ideal anesthesia yet presented, both from the standpoint of the patient and that of the surgeon. However, if we use this form of anesthesia it should be properly labeled as "narco-local anesthesia" and not "local anesthesia".

The splanchnic nerve anesthesia mentioned by Dr. Labete, and which I have mentioned in my paper, has, I believe, great possibilities. At present the technic of reaching the splanchnic nerve is difficult. We have tried it in 150 cases, often going through the liver, after the abdomen was opened. Kappis and Braun have done a good deal of this work and reports satisfactory results. To reach the nerve from behind one must travel a great distance and, while we have tried on the cadaver to work up a method, the distance is so great that we have not been able to establish a satisfactory technic.

DR. A. F. BRATRUD, Minneapolis (closing): I just want to say a word about the peritoneum. In a case where there is any inflammation in the peritoneum, especially of the viscera, you must not handle visceral organs. You can handle them provided there is not much inflammation.

I have injected the cystic duct in some gall-bladder cases because I find you can retract the liver quite well.

I would like to ask Dr. Labat if he had any vomiting or distress after injecting the splanchnic nerves.

DR. G. L. LABAT, Paris: In a few cases we had just a little vomiting and distress, but I thought it was due to an error in technic for later on in our last 45 cases we had no untoward effects.

# DELAYED UNION AND NONUNION OF THE RADIUS AND ULNA\*

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To the surgeon interested in the problems of reconstruction surgery come a large number of persons who have had injuries to the forearm with delayed union or nonunion in either or both the radius and ulna. Complications other than delayed union and nonunion, such as deformity, infection, comminution, loss of bone substance, muscle degeneration, stiffness in neighboring joints, bone atrophy, impaired blood supply, and general constitutional disease, further tax the ability of the surgeon to restore function. With the full cooperation of the patient and sufficient time, the surgeon has means at his disposal by which he may solve most of the problems complicating impaired union. While the failure of some fractures to unite may be due to faulty reduction and incomplete fixation, the interposition of periosteal structures, necrosis, loss of bone substance, and impaired blood and nerve supply, there is a group in which neither syphilis nor any of the foregoing factors appear, but in which the process of ossification ceases before union is complete.

Fifty-nine patients with delayed union or nonunion were observed in the Mayo Clinic from May, 1913, to June, 1920; the average length of time since fracture was more than fifteen months. The Wassermann tests made on the blood of thirty patients were negative. Two patients gave a history of syphilis, but had negative Wassermann reactions and the clinical evidence did not indicate the presence of the disease. Imperfect reduction, inadequate fixation, and too early use appeared to be the principal causes in the group of cases of delayed union and nonunion of the forearm. Many of the patients had been treated by means of splints extending only a few inches beyond the fractures, and even if the fractures had been properly reduced, the slightest motion allowed the fragments to slip by because of the inadequate fixation. In order properly to hold the reduced fractures with

splints, it is necessary to carry the fixation beyond the elbow and beyond the wrist. The suspension, traction and counter-traction method of treating fractures has many advantages, since it allows reduction with free circulation and motion in the neighboring joints, while the tension of the muscles tends to act as splints and hold the fractured ends in a position. If immediate reduction were procured and maintained for a sufficient length of time, without interference of circulation, nonunion would be even less rare than it is at present. In civil practice properly employed splints and plaster as a means of fixation give eminent satisfaction and will continue to be used in injuries of the upper extremities.

Röntgenographic examination of all fractures is advisable before reduction and should be made in the form of a permanent record, plate, or print. A similar record should be made immediately after reduction and at regular intervals until the patient is dismissed from observation. When the fracture has been reduced and immobilized, roentgenographic records and notes should be made concerning the circulation during the treatment; thus the surgeon will have evidence of great value should the question of the responsibility for nonunion, or other complications, arise.

The time of immobilization varies with the patient and the type of fracture. When the average period of fixation has expired and examination still shows motion, delayed union occurs and further fixation is required; nonunion results when the usual measures have been tried for a longer period and motion remains at the site of fracture. If it persists, a pseudo-arthritis usually results with fibrous union, and the ends of the bone often grow outward and form claw-like ends, when they are close together, or long tapering ends, when they are widely separated. In the long standing cases the medullary cavity is closed at the fractured ends by hard cortical-like bone. It is difficult to set a time limit on when delayed union becomes nonunion. The committee on fractures of the American Surgical Association found the average period of disability in fractures of the shaft of the bones of the forearm to be ten and eight-tenths weeks. Delayed union may, therefore, occur after three months, and if the fracture remains united after a similar length of time, it may be considered to be

\*Presented before the Southern Minnesota Medical Association, Mankato, November, 1920.

nonunion, even though fibrous union has occurred.

The cases considered to be nonunion in this report are fractures of the radius and ulna which have failed to become firm within six months. While the disability may persist ten and eight-tenths weeks, practice demonstrates firm union in many instances in half that time and statistics with regard to the time required vary with the accuracy of the reduction and the type and perfection of the fixation, and so forth. In our practice, the duration of fixation is based on the roentgenographic and clinical findings, and no definite prognosis of the time to be devoted to splints is given. This is especially true in the cases of bone graft in which extreme care must be taken.

In the Mayo Clinic patients presenting delayed union or nonunion of the bones of the forearm are submitted to a complete history taking, clinical examination, urinalysis, and Wassermann test. If splints are worn and permit of roentgenographic examination, two plates are taken at right angles to show the extremity. Usually the patient comes without fixation and with some obvious deformity and nonunion. Should the history of clinical findings suggest the possibility that syphilis is a possible factor, the patient is given a provocative test and the opinion of a syphilologist obtained even though the Wassermann test is negative. If more than six months has elapsed since the fracture nonunion is diagnosed; if less time has elapsed, delayed union is diagnosed. If nonunion is diagnosed, the contra-indications to operation must be considered. Should infection be present a preliminary operation is performed; sequestra or Lane plates are removed and after excision of the scar tissue the wound may be allowed to granulate from the bottom, or secondary suture performed. If there is a bone abscess the cavity should be curetted thoroughly, and dished, and the wound packed or Dakinized. Any deformity which may be corrected by manipulation or without undue injury to uninfected tissue should be attended to and the arm splinted in a manner to allow dressings. Union may occur without further interference in a small percentage of cases; in the remainder operation is deferred until healing has occurred and all evidence of dormant infection has disappeared. It is best to

loosen up neighboring joints, improve the blood supply, and overcome the bone atrophy in all cases so complicated before performing an operation for nonunion. The general health of the patient is also of importance in obtaining satisfactory results and special attention should be paid to those who are anemic and undernourished.

#### OPERATION

The technic of the bone graft operation has been discussed by various writers with different opinions on the subject. Our experience has led us to favor the massive graft held by beef-bone screws, and external fixation by plaster of Paris casts. Care must be taken to correct deformity: if necessary, bone is sacrificed to prevent undue strain on the transplant. These massive grafts, with medullary bone containing the preponderance of bone-forming cells (osteoblasts) are easily obtained in any shape and size from the flat internal surface of the tibia. By removing half the transverse section of the fractured bone ends for a distance of 2 or 3 inches and holding the graft firmly with four beef-bone screws, a strong well fitted transplant may be inserted. The graft should be of good size, preferably larger in cross section than the excised half of the bone operated on (Fig. 1, g). Thus a strong splint remains, first uniting at the points of approximation, where living cells of both graft and fractured ends exist, and, if absorption takes place, new bone forms a bridge before the graft is weakened, and the danger of fracture is past. Grafts have been observed apparently united and patients have been assured of good results which ended in refracture and disappointment because small grafts had become weak and gave way on removal of fixation. Splints should be maintained until roentgenographic evidence proves that strong osseous tissue has formed and then the graft should be subjected to careful increasing use so that it may grow in size and strength equal to the strain required for function. On several occasions I have seen bone grafts give way due to the sudden removal of fixation and too great strain. Fortunately the fractured grafts may throw out a callus and unite if fixation is again resorted to. If it is possible to overlap the ununited fragments and apply a bone graft, the results will invariably be improved (Fig. 1 e, f). In all cases the medul-



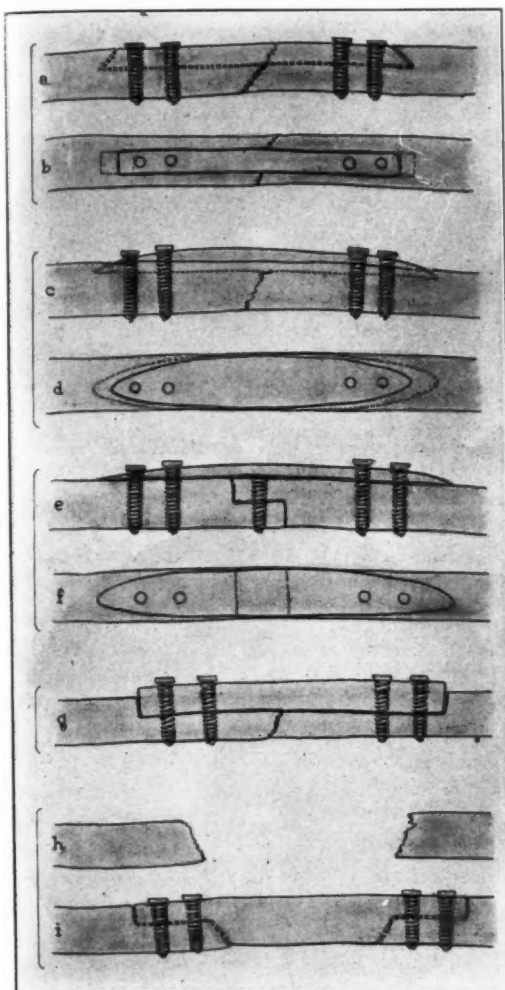


Fig. 1. a and b. The inlay autogenous graft, held by four beef-bone screws. c and d. Beef-bone plate applied and held with four beef-bone screws. e and f. The use of five beef-bone screws, the bone fragments stepped or overlapping; a screw passes through this overlapping portion and gives a broader approximation. g. Massive autogenous graft held with four beef-bone screws; a satisfactory method giving a large percentage of favorable results. h and i. Method of bridging the separated fragments with an autogenous graft from the fibula held by four beef-bone screws.

lary substance should be opened by a drill or an instrument such as the Murphy reamer. Light massage and careful exercise on removal of splints aid in improving circulation and loosening stiffened parts and are advised routinely. The splints may be removed during the day and

applied at night in order to prevent injury during sleep.

#### NONUNION IN THE RADIUS AND ULNA

(Mayo Clinic, May, 1913, to June, 1920)

Patients (54 males, 5 females).....	59
Patients operated on for nonunion before examination at the Clinic (one had had seven operations), (54.4 percent).....	32
Average age (oldest patient 78, youngest patient 8), years.....	33
Average time since fracture, months.....	15
Longest time since fracture, years.....	19

#### SITE OF DELAYED NONUNION

Radius and ulna (right 28, left 19) .....	47
Radius (right 5, left 3) .....	8
Ulna (right 1, left 3) .....	4

#### OPERATIONS

Lane plate .....	6
Bone graft .....	31
Removal of Lane plate (three plates applied at Clinic) .....	8
Drainage for infection .....	10
Sequestrectomy, manipulation and so forth.....	4

#### BONE-GRAFT OPERATIONS

Patients (29 males, 2 females) .....	31
Average duration of nonunion (months).....	22.2
Nonunion in radius and ulna (right 7, left 3)....	10
Good union .....	4
Improvement (ulna only united)....	2
Failure .....	1
Information not obtained .....	3
Nonunion in radius (right 10, left 8).....	18
Good union .....	13
Improvement .....	1
Failure .....	1
Information not obtained .....	3
Nonunion in ulna (right 1, left 2) .....	3
Good union .....	1
Information not obtained .....	1

#### RESULTS OF OPERATIONS

Patients from whom information has been received .....	34
Good union .....	25
Failures .....	7
Improvement .....	2
Patients whose operations are too recent to include in results .....	7
Patients from whom information could not be obtained .....	18

#### REPORT OF CASES

*Case 182430.* Mr. A. E., aged 44, came to the Clinic January 8, 1917, because of nonunion of the right radius and ulna of nineteen years' duration. The patient stated that the bones never felt strong following the fracture and he believes that there was no union at the end of three years. Two years before he had had the bone ends sawed off and held with catgut sutures. No benefit was obtained. Four months later an inlay bone graft was used without any benefit.

Our examination showed the nonunion in the right radius and ulna and malposition. The Wassermann test was negative. January 18, 1917, a bone graft from the left tibia was removed and used; the radius was held by a combined intramedullary graft, the graft being driven down into the lower fragments

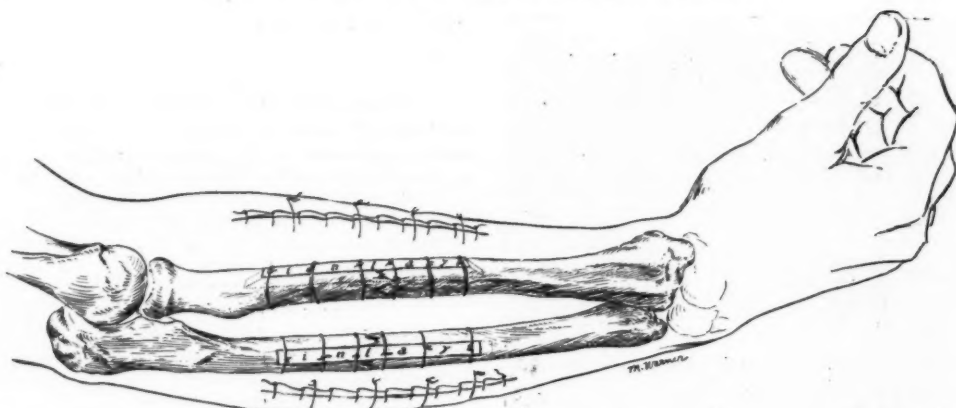
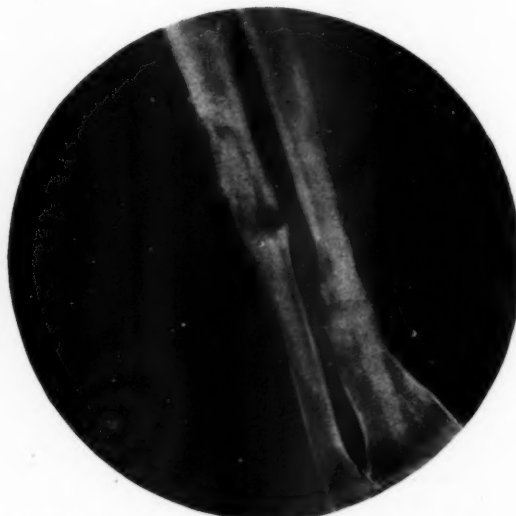


Fig. 2. A method of inserting the inlay graft, the or four threads of catgut are passed around to Fixation is obtained by separating the fragments, inserting the graft, and then allowing the muscle pull to hold the graft firmly in position. Three ends of which taper off into the medullary canal. help hold the graft.



Figs. 3 and 4. (Case 182430). Nonunion of the right radius and ulna of nineteen years duration. Before and after operation.

and used as an inlay in the upper fragments. The upper end of the graft was fitted in the cortex so as to hold it firmly in place. The ulna was treated in a similar manner and chromic catgut was used to aid in holding the fragments. A plaster of Paris cast was applied. An iron screw was removed from the radius during the operation; no record of when it had been applied could be obtained from the patient. A good result followed the operation. The union in the radius was firm, and when the patient was dismissed the ulna was also firm. Three years later he wrote stating the radius was firm but he thought that there was slight motion in the ulna. The functional result of the forearm is good. (Figs. 2, 3, and 4).

*Case 220901.* Mr. S. K., aged 30, was examined February 1, 1918, for ununited fracture of the right humerus and radius and ulna. Fifteen months previously his arm had been caught in the crank shaft of an engine, with a fracture of the right humerus at the juncture of the lower and middle thirds and the radius and ulna in the middle third. The fracture had been set and a plaster of Paris cast applied for three weeks with the arm at right angles; this was followed by splints. Because of malposition and questionable union the arm was refractured and realigned in the third month and again in the tenth month following the injury, without result.

Our examination showed nonunion of the right radius, right ulna, and right humerus. The ulna was

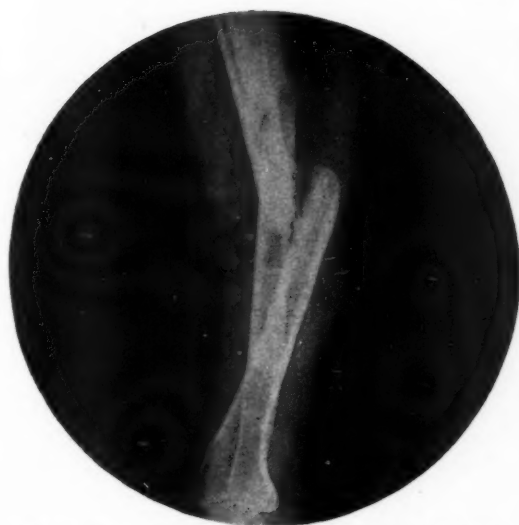


Fig. 5. (Case 220901). X-ray before operation showing malposition and nonunion of humerus, radius and ulna.

well aligned, the radius was overlapping and some callous formation and overriding of the humerus were shown in the roentgenogram. The medullary canal was filled in with hard bone at the sites of fracture. The arm was held midway between pronation and supination, and the elbow at an angle of 100 degrees. February 7, 1918, we exposed the ends of the radius, freshened them, reamed out the medullary cavity and placed a beef-bone screw in the medulla to hold the bone fragments in alignment. The bone screw failed to hold and the graft slipped, and three



Fig. 6 (Case 220901). Firm union of the humerus, radius and ulna following bone graft to radius and fixation with plaster cast six months.

weeks later a second operation was performed. An autogenous graft was inserted and held in place by six circular catgut ties. The arm was maintained in plaster for six months, and firm union in the radius, ulna, and humerus was demonstrated clinically and by x-ray. The functional result was good. (Figs. 5 and 6.)

*Case 255584.* Mr. H. L. D., aged 35, came to the Clinic for examination January 8, 1919. Fifteen weeks previously he had been caught in a sprocket wheel and pulled underneath a machine, sustaining a compound fracture of the right radius at the juncture of the lower and middle thirds. The wound drained for four weeks, during which time dressings and splints were applied.

Our examination showed delayed union, malposition, and no supination; the hand was held in pronation. It was obvious that if union should occur, function would be impaired. The fractured ends were filled in with hard bone, and the radius shortened; the lower fragment lay against the ulna.

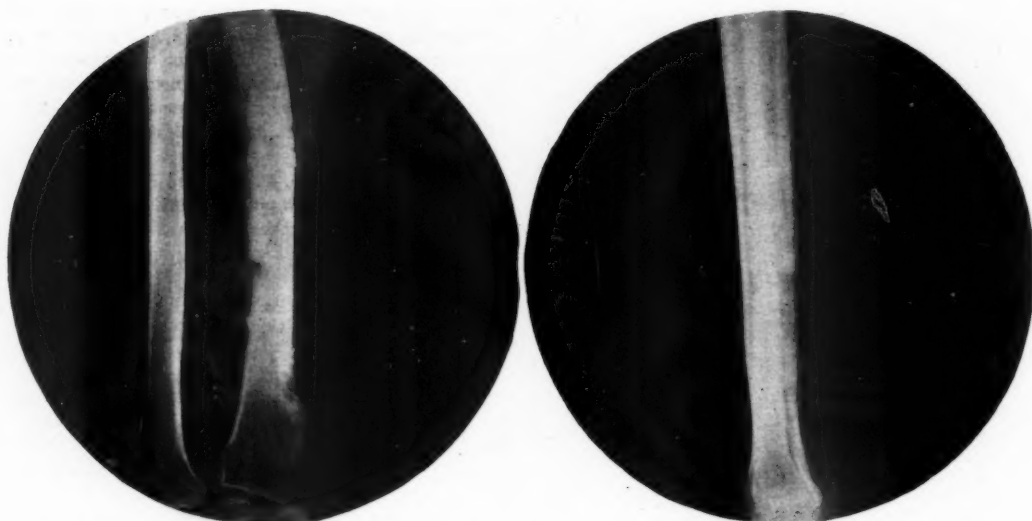
The fracture was realigned and the fractured ends of the bone were freshened so as to open the medullary canal. A large autogenous graft from the flat internal surface of the left tibia was applied side-to-side and held in place by four beef-bone screws. Firm union with good function resulted (Figs. 7, 8, and 9).

#### CONCLUSIONS

1. The massive bone transplant has given the most satisfactory results and may be held firmly by means of beef-bone screws.
2. The flat internal surface of the tibia supplies a graft of almost any required size and



Fig. 7 (Case 255584). Delayed union of the radius of fifteen weeks' duration with malposition and obliteration of the medulla at the site of the fracture.



Figs. 8 and 9 (Case 255584). Radius shown in Figure 7, twenty-two weeks later: firm union; beef-bone screws still visible. Note the periosteal tag between the radius and ulna casting a shadow due to bone growth.

shape, and with medullary bone rich in osteoblasts allows a wide approximation which insures early union.

3. Fixation by a plaster of Paris cast from the fingers to the mid-humerus is a satisfactory method.

4. Fixation should be maintained until firm union and a strong bridge of bone are demonstrated.

5. The arm should be used gradually on removal of fixation, as the graft fractures when it is subjected to sudden and too great stress.

6. Fractured grafts may reunite when given further fixation.

#### BIBLIOGRAPHY

1. Block, L.: Non-union of fractures. *Am. Jour. Surg.*, 1919, xxxiii, 190-191.
2. Estes, W. L., Jr.: A study of the causes of delayed union and non-union in fractures of the long bones. *Ann. Surg.*, 1920, lxxi, 40-46.
3. Henderson, M. S.: The transplantation of bone in ununited fractures of the shaft of the humerus. compound fractures. *Ann. Surg.*, 1920, lxxi, 182.
4. Henderson, M. S.: The use of beef-bone screws in fractures and bone transplantation. *Jour. Am. Med. Assn.*, 1920, lxxiv, 715-717.
5. Willard, De F. P.: Treatment of non-union in compound fractures. *Ann. Surg.*, 1920, lxxi, 132-186.

#### SURGICAL TUBERCULOSIS IN CHILDREN\*

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Surgical tuberculosis in children, that is tuberculosis of the bones and joints, is a subject that it will be impossible to more than touch upon in a single paper. Many volumes have been published dealing with these conditions and numerous articles are appearing constantly which discuss one or more of the many subdivisions. I shall endeavor, however, to cover briefly the general field, emphasizing a few important points and giving more in detail the management of such cases at the Minnesota State Hospital for Indigent Crippled and Deformed Children, in St. Paul. The necessity for such a hospital will also be dwelt upon.

It is generally recognized that both the human and bovine types of tubercle bacilli may infect children, but the proportion of one to the other apparently varies greatly, and for a simple reason. The bovine bacilli undoubtedly gain entrance to the human body mainly through the ingestion of infected milk, that is milk from tuberculous cows. In countries where the milk

\*Read before Mississippi Valley Conference on Tuberculosis, Sept., 3, 1920, Duluth, Minn.





Fig. 1

supply is not so carefully guarded as in ours the incidence of the bovine type of infection is very high, while with us it is probably so low as to be almost negligible. The bacilli, either type, gain entrance to the body chiefly through the digestive and respiratory tracts, the mesenteric, bronchial, and cervical glands becoming primarily infected. From these points they may be carried to any part of the body by the blood stream and there cause active disease. The less common portals of entry are the tonsils, mucous membrane of the pharynx, infected roots of teeth, the skin and genito-urinary tracts.

The importance of heredity as a predisposing factor in bone and joint tuberculosis is still a widely debatable point, but I believe that one can say, without much fear of contradiction, that the tuberculous mother undoubtedly transmits to her offspring a weakened condition of tissues which predisposes to tuberculous infection. Of course the presence of active pulmonary tuberculosis in a household makes more than probable the infection of other members of the family and an analysis of our cases at the State Hospital shows this to be a fact, for a high per-

centage of family histories show active disease.

There has recently been published an article reporting the findings of tubercle bacilli in the mesenteric glands of a certain number of still born children which substantiates earlier reports and makes the possibility of a true hereditary or congenital infection a fact which must be admitted.

Injury of a slight character would seem undoubtedly to be a factor in localizing tuberculosis, but whether this is due to the activation of a quiescent focus already present, or to the forming of a point of lessened resistance is still doubtful. Probably the former is the more common condition and we can readily understand how important as a cause an injury to an already sensitive joint would appear to the patient or parent.

Other predisposing factors which must not be forgotten are influenza, the exanthemata, especially measles, and lowered vitality from underfeeding and improper hygiene. At the State Hospital we admit more cases of bone and joint tuberculosis from the county covering the Iron Range than from any other county, due largely,



Fig. 1a

I believe, to the conditions under which the population, mostly foreign born, lives. It is vital therefore that these predisposing factors be removed, if the incidence of infection in children is to be lowered. Public health nursing will undoubtedly accomplish a great deal towards this end.

The pathology of bone and joint tuberculosis need only be touched upon here, but enough must be said to make clear that which follows. Pure diaphyseal bone tuberculosis, without joint involvement, is so rare in this country that it can be ignored, practically all cases being of the joint type. A joint should be considered as consisting of the ends of the articulating bones, the ligaments and capsule holding them together, and the synovial membrane lining the joint. Authorities differ in their statements regarding the points of original invasion by the tubercle bacillus but it is becoming more and more an accepted fact that the original focus is found about as frequently in the synovial membrane as in the bone ends; however in the spine, there being no synovial membranes between the vertebral bodies the lesion is necessarily primary in bone. The cartilages and ligaments, are, of

course, passive structures in joint disease and are never primarily involved. The disease once started, the lesions may vary from simple involvement of the synovial membrane to complete disorganization of the joint with marked destruction of bone. Pus may be present and this, together with the detritus resulting from the disease, may form a tuberculous abscess or, as it is commonly called a "cold abscess." The spinal cord may be involved to a greater or less extent in disease of the spine and a paraplegia result.

The spine is by far the most common site for surgical tuberculosis in children, the hip, knee, elbow, and ankle being next, in probably the order given, although statistics differ somewhat on this point. The wrist and hand are less frequently involved and the shoulder joint comes last on the list.

The signs and symptoms of the disease are fairly typical: stiffness and pain are outstanding features, with limitation of motion, muscular rigidity, swelling, atrophy of muscles and bone, and tenderness being almost constant features. Abscess formation occurs in a certain percentage of cases. The general condition of

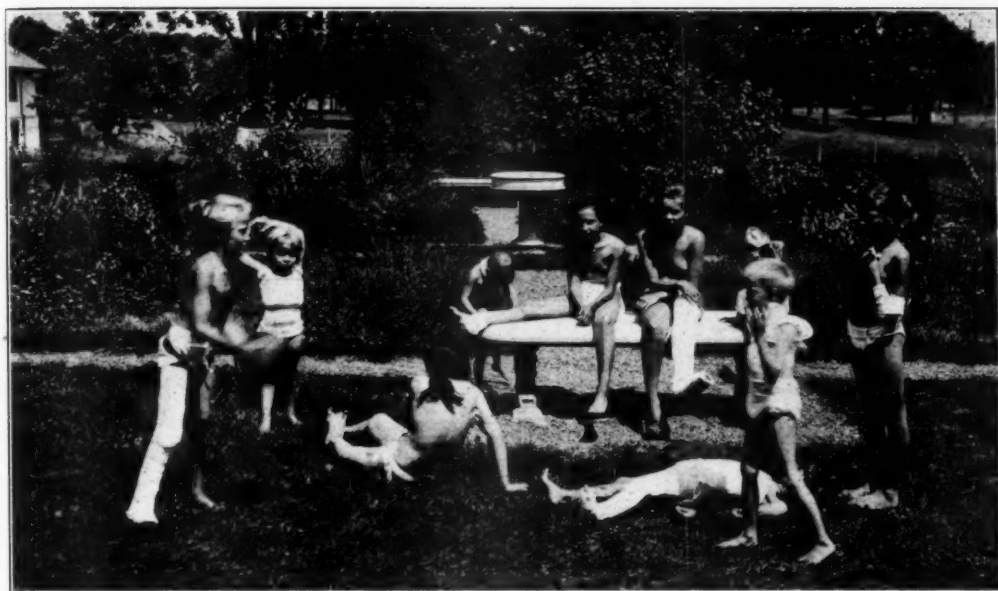


Fig. 2

the patient is below par and loss of weight, debility and fever are frequently present.

Early diagnosis is essential if the best results are to be obtained and for this purpose it is necessary that the physician keep constantly in mind the possibility of such an infection. The dictum that a subacute or chronic painful disease involving one joint only, in a child is practically always tuberculous, should never be forgotten.

Pott's disease or tuberculosis of the spine gives symptoms which should in most cases be recognized before the occurrence of the deformity but unfortunately the parent frequently waits until the "lump on the back" appears before seeking medical advice. Then of course there is no mistaking the diagnosis. A child who complains of pain in the back of the head or in the shoulders and arms, holds the neck still and protects himself from all sudden movements, or who complains of severe intercostal or abdominal pain with the same protective symptoms, all of which are not due to some apparent cause, should immediately be under suspicion. At the State Hospital we not infrequently admit cases which have been treated for digestive disorders for long periods of time on account of "pain in the stomach" and not until the deformity of the

spine appeared was the true condition recognized. This referred pain is so typical that its importance can not be overestimated.

The same is true in tuberculous infections of the hip-joint. There the typical pain is on the front and inner side of the knee due to the irritation of the obturator and anterior crural nerves. The fact that we sometimes see cases of this kind with all treatment directed towards the knee joint, even going so far as the application of splints or plaster of Paris shows the importance of remembering this feature.

The knee and ankle joints and joints of the upper extremity being more superficial than the spine or hip joints, the diagnosis is fairly simple

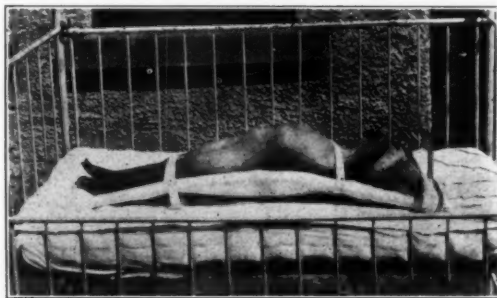


Fig. 3



Fig. 3a



Fig. 4



Fig. 5

when they are the site of tuberculous lesions. Here the local swelling, accentuated by the atrophy of the muscles, the tenderness, the local pain and the muscle spasm are very typical.

The prognosis of all bone and joint tuberculosis in children is on the whole good as regards life. In infancy the mortality is high, but otherwise, if mixed infection is prevented and multiple joints do not become involved there is little danger. Locally ankylosis of the fibrous type is to be expected so that joint function rarely returns to normal.

The treatment must be both general and local. The general treatment aims at the building up of the patient and the improvement of the hygienic conditions so that the surroundings are such as will best help the patient to fight the disease. It is very surprising to see how quickly patients pick up in weight and in general appearance after coming to the State Hospital. The fresh air, good food, tonics and heliotherapy

cause such remarkable changes that one frequently wishes it were possible to treat private cases in an institution of this kind. The advantages of a state institution for the care of such cases is so apparent that it can not be long before every state has such a hospital available.

Heliotherapy, or the sun treatment of surgical tuberculosis deserves further mention. Rollier, of Leysin, Switzerland, has been the most prominent advocate of this treatment and it is largely due to him that its value has been recognized and the proper methods for its application worked out. The principal effects of direct sunlight upon the body are, first, that of a strong tonic, building up the general bodily resistance to infection and, second, that of a bacteriocidal agent. The ultra violet rays are the active constituents of the light and as these are filtered out by glass it is necessary that the patients be in the open, but protected from winds if the temperature is low. The high altitude of





Fig. 5a



Fig. 6

Switzerland seems to be of great additional advantage, but treatment even at sea level has been so advantageous that a low altitude is no contra indication for this treatment. The application of the sunlight must be very gradual and the condition of the patient watched carefully during the first few weeks. It is best to make out a regular schedule for the exposures following in general the scheme of Rollier.

Albee quotes Rollier as follows: "The first day only the feet are exposed at intervals of one hour, five times and for a period of only five minutes. The next day the legs will be exposed and the same method followed. The third day the legs will be exposed as far as the groin. The upper portion, from the knee to the groin will be exposed for five minutes three or four times; the lower portion, from the knee to the ankle for ten minutes. The fourth day the abdomen will be the new seg-

ment; the fifth day we will proceed to the insolation of the chest with the same precautions and covering the region of the heart with a damp cloth.

"If the condition of the patient will allow it, he will be placed on his stomach and present alternately the front and back of his body to the sun, which increases the total number of exposures to six or eight. Lastly, the sixth or seventh day, we will be able to expose the neck and head, due attention being paid to how he accustoms himself to it, and to pigmentation of the integuments. The preliminary precautions will soon be no longer necessary, and the patient will be able to tolerate the sun for six or eight hours with perfect comfort in winter as in summer.

"The pigmented integuments, over all their surface, take a beautiful bronze tint, varying from coffee to chocolate color. We have insisted particularly on the importance of the pig-



Fig. 6a



Fig. 7

mentation . . . which is nearly always proportional to the resistance of the patient. Delay or absence of its early appearance permits one to form a prognosis with the utmost certainty. . . ."

At the State Hospital we have found that the patients can be exposed more rapidly and for longer periods of time than the above indicates, probably because of the lower altitude. The results are shown in the photographs. Figs. 1, 1a and 2. The Alpine lamp, a mercury vapor lamp in quartz bulbs, can be used as a substitute for sunlight when the climate does not permit the latter but its effects can not be compared with the natural sunlight. Pigmentation seems to be less, but discharging sinuses some times clear up in a striking manner with its use. It is in constant use at the State Hospital in the winter and when the weather is unfavorable.

The local treatment of the various joints is

of equal if not greater importance than the general treatment and care must be taken not to neglect it in one's enthusiasm for heliotherapy. Innumerable forms of apparatus and appliances are used in this local treatment but the principle of all is the same, and that is fixation. Traction and extension are accessories. Knowing that the cured tuberculous joint is in most cases ankylosed, it is very important to see that the actively diseased joints are held in the best position for function after this ankylosis has occurred. These positions are, with a few exceptions, as follows: the hip in moderate abduction, slight flexion and a few degrees of external rotation; the knee, not more than 10 degrees from straight; the ankle, at a right angle; the shoulder, in slightly less than right angle abduction, partial external rotation and some forward flexion; the elbow, around or inside a right angle; and the wrist in a moderate cocked-up position.



Fig. 7a



Fig. 8

The methods which we have found most satisfactory at the State Hospital, and our statistics encourage us to continue with them, can be enumerated without taking much of your time. In tuberculosis of the spine the simple gas pipe frame, curved if necessary to give hyper-extension is used in the routine treatment of all acute cases. [Fig. 3, 3a and 4.] The position is varied daily in the subacute and convalescent cases by allowing the patient to lie in the prone position, raising on the elbows if he wishes. Later, that is in six months or a year, a brace or plaster jacket is applied and the patient allowed up. (Figs. 5, 5a, 6, 6a, 7 and 7a.) The operative fixation of the spine by the method of Albee or Hibbs is not used, as we feel that in children our results are so good that the subsection of the patient to operation is not necessary. Cases with paraplegia are also handled conservatively.

Hip joint disease is treated on the Jones ab-

duction frame or by a plaster of Paris spica. (Figs. 8, 8a and 9.) Traction is used in the acute cases to lessen intra-articular pressure. When much deformity is present the weight and pulley is used until it is corrected or, as sometimes happens, if complete correction is not obtained, gentle manipulation under an anesthetic is necessary to accomplish

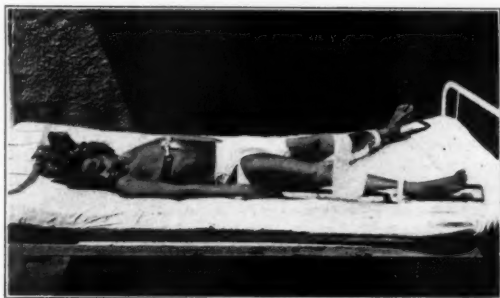


Fig. 9



Fig. 8a

this. If a spica is used the child can be up early, but it is considered better not to allow weight bearing and so the sole of the shoe on the sound side is raised about two inches and crutches are used. In this way the diseased leg hangs free.

Knee joint tuberculosis can usually be handled easily with plaster of Paris, (Fig. 10) weight

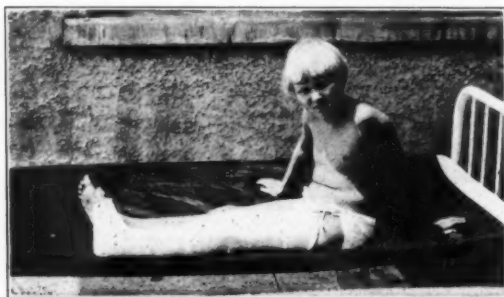


Fig. 10

bearing in the acute cases being prevented by keeping the child in bed or by using a high shoe as in hip joint disease. In convalescent cases a stiff knee brace can supplant the plaster.

Ankle and wrist joint lesions are held with plaster of Paris or light metal splints and the same is true of shoulder joint cases.

The tuberculous elbow is held in the plaster of Paris or in the so-called "collar and cuff" attachment of Jones which consists of two leather sleeves, one around the wrist and the other around the neck, through which a bandage is passed and so tied that the elbow is held in rather acute flexion with the hand against the neck.

Abscesses, when present, are left rigidly alone unless causing pain or discomfort from their size or unless they show signs of breaking through the surface by thinning of the skin and pressure necrosis. The great danger in these cases is mixed infection and its immediate result of sinus formation and chronic suppuration. Most of the deaths we see following surgical tuberculosis are due to amyloid disease resultant upon this long continued suppuration. Open incision and the insertion of a drain are never resorted to therefore but the abscesses emptied, when indicated, by aspiration, repeated as often as may be necessary. In this way no opening to the outside remains and the danger of mixed infection is reduced to a minimum.

The time necessary for the cure of all these various forms of surgical tuberculosis varies greatly but on the average children must be under active supervision for from two to three years. To do this properly in the home is almost impossible especially with the poorer class of people among whom bone and joint tuberculosis is most prevalent, and hospitalization is the only solution. Dispensaries with visiting nurses and social departments can only go so far and their main function, with the type of cases under discussion, should be the picking out of cases for the hospitals and the supervision of such cases after their discharge. Too strong a plea for the establishment of state institutions for the care of surgical tuberculosis in children can not be made. One needs only to compare cases when sent in for admission with the same cases some weeks or months later to see the reason. Lives



are saved and children who would become life long charges of the state are transformed into useful and productive citizens.

Let us hope that before long every state in the Union will accept its responsibility for the crippled and deformed children within its borders, as a few states already have, and maintain for them institutions such as Minnesota has in St. Paul.

### OCULAR IMBALANCE\* (Heterophoria)

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At the last year's meeting of the A. M. A., Dr. Samuel Theobald called attention to the meagre reports of ocular imbalance in the large eye and ear hospitals of the country, and his conclusions were that one of two things is lacking; either that the heterophorias from muscular anomalies are practically ignored in the case reports, or that they have been overlooked. He also called attention to the underestimation of muscular faults by many ophthalmologists and reminded us that while heterophorias are less common causes of asthenopia than refractive errors are, and that while they do not always accompany such errors, they are capable by themselves of producing manifest symptoms both local and remote, which some have learned to attribute to eye strain.

In choosing my subject I had no idea of trying to present any new thing to ophthalmologists but had in mind calling to the attention of the general practitioners—particularly those who do refractive work—to the prevalence of this condition, with some suggestive methods of treatment which have given me better results than any I have tried heretofore. Pardon me if I briefly refer to what we mean by "heterophoria."

We describe it as a tendency of one or both eyes to depart from parallelism when in a state of rest and the positions assumed may be as follows: perfect binocular balance is known as orthophoria, a tendency of one visual axis to swing in is known as esophoria, to swing out

as exophoria, upward as hyperphoria, down as catophoria and any combination of two of these as upward and inward, as hyper-esophoria, etc. A tendency of both eyes to go above the horizontal plane of the head is known as anophoria, and any inefficiency or over action of the obliques as cyclophoria. With some who have dormant or sluggish nerve sensibility, these conditions in moderate degree seem not to have any particular disturbing influence while in others of greater sensibility they cause most distressing symptoms, and whether accompanied by refractive errors or not, there is often untold misery. Such deviations may have for their cause faulty insertion of ocular muscles, abnormal development of the orbits, anomalies of refraction, innervational disturbances, exhaustion from overworked eyes, and the cardinal symptoms may be briefly states as follows: first, a burring or indistinctness of vision coming on after more or less prolonged use of the eyes at the near point, due to inability of the eyes to maintain accommodation or convergence without strain, or possibly from inherent weakness of accommodation, which act is generally admitted to be the result of action of the ciliary muscle on the lense changing its curvature; but this is emphatically disputed by at least one writer who has, after long and careful investigation, become convinced that this theory is wrong; second, headaches innumerable both in degree and variety, varying from slight discomfort, hardly noticeable, to a pain practically unbearable, and perhaps accompanied with gastric symptoms. Its location varies, but it is usually of the frontal type but may be referred to the temple, the base of the back of the neck, constituting what is commonly called the "check rein feeling." Rarely is it referred to the vertex and it may be differentiated from frontal sinus infection or obstruction by the absence of "Ewing's sign;" third, hyperemia of the conjunctive, though not always present, is occasionally, and the association between it and imperfect accommodation is very striking. Lachrymation may be present, and the overflow so abundant and constant as to suggest lachrymal stenosis, but it disappears after refractive errors and eye strain have been removed. Vertigo sometimes occurs.

The varying conditions contributing to eye-

\*Read before the Southern Minnesota Medical Association, Fairmount, June, 1920.

strain are so complicated and so numerous as to make it impossible to prescribe glasses so as to give relief and comfort with any degree of certainty by the refraction alone even when refractive errors appear to be the assignable cause. If we rely upon refraction alone, not taking into account contributing causes, as faulty accommodation, orbital malformations, status of extra-ocular muscles, we shall often fail, for, to correct hyperopia accompanied with exophoria of any marked degree will aggravate the trouble and be like goading a jaded horse. This would also be true with many other refractive conditions complicated by heterophoria.

It should be our aim to adjust corrections—so far as possible—so that the intrinsic and extrinsic muscles can work together in harmony, and in order to do this I have sometimes found it necessary to prescribe lenses the opposite of that which the refractive error called for. This sometimes brought satisfaction. Stevens, in his book "Motor Apparatus of the Eyes," describing the conditions of asthenopia and muscular anomalies, calls it "a perplexity from associate movements, caused by continuous compromising adjustments that have to be made which causes the pain and weariness so characteristic of these affections," and it seems to me no better explanation can be made.

We may illustrate in part, at least, by the attempt to use strong magnifying glasses; at first only a slight discomfort is felt but if the attempt be prolonged vertigo and nausea will ensue. This does not occur if one eye be closed, hence the disturbance must be in the confusion arising from efforts at binocular vision under difficulty. As nature abhors a vacuum so does she diplopia. There are cases where the anomalies are due to faulty attachment of muscles. In such, operation is often justified and it may be the only alternative for relief. Where the trouble arises from inherent or acquired weakness of the muscles, improper development, paresis, then gymnastics are indicated; when from overuse, general systematic depletion by illness or following major operations, then rest must be the remedy. Recovery may be a slow process, as many such, date the inception from a sick bed and often by excessive use of the eyes while reading when time hangs heavy. When caused by over-use, bad light, or refractive er-

rors, the continuance of use under the same conditions can only aggravate the affection.

We are sometimes able to relieve weakened muscles temporarily by the use of prisms but they are only a crutch and the muscle relieved, relaxes effort, looses a part of this stimulus, gets lazy, becomes weaker still so that from time to time stronger prisms are required and the patient is not cured.

In times past, and even to the present, remarkable cures have been reported of relief from heterophorias and also from remote reflex phenomena by partial or complete tenotomies or the readjustment of faulty detached muscles of the eyes; but the method while still in vogue is not so common as some twenty years ago. It has its place and is sanctioned where other methods fail. Disciplinary treatment has been recognized, advised, and various methods recommended, but as ordinarily used has been very unsatisfactory in my hands. Wall to wall, ceiling to floor, target and candle, and even prism practice as advised have availed me little.

The difficulties with them all, I believe, is in permitting patients to employ them without supervision. To attain success with any disciplinary method the muscles must be regularly, intelligently and systematically exercised and not overworked, and with prisms, these must be placed correctly, quickly; this is hardly possible for the patient to do without time intervening between changes, giving opportunity for muscle relaxing in the interval. Regularity, accuracy, persistency and rapidity are prime necessities for success. To satisfactorily impress these facts upon patients is practically impossible for me to do as they invariably fail to follow instructions, and consequently, whenever I am successful with them, it is because of supervision, encouragement, directing and watching the effects from day to day: otherwise I accomplish practically nothing. Patients who practice at home—except when using prisms—are unable to note progress and they may overwork and lame the muscles and thus do harm instead of good.

Within a comparatively few years instruments have been invented which simplify prism practice for they do away with the spectacle frame and the slow process of prism placing, assure accuracy of position, leaving no oppor-

tunity or interval for the eyes to relax convergence or accommodation.

The DeZeng and other phorometers are valuable instruments for quick and accurate diagnosis, and the revolving prisms can be used for discipline. However, for this, I prefer the "Hazen Kratometer" having used it for the past six years, as my patients complain that with the revolving prism the light target changes shape and color about the time twenty-five or thirty degrees have been reached, and it is my observation and impression that they do not lift as many degrees with it as with the prism bar.

Dr. Hazen, of Des Moines, an ardent student of heterophorias and a champion advocate of muscle training, invented some years ago his so-called "Kratometer." With it I find the work greatly facilitated and simplified as it does away with the uncertainty and inconvenience of other prism practice. By its use, I have been able to score results never before attained. With the newer devised and recommended stereoscopic methods I have had no experience. Some of the first cases treated with the Kratometer were disappointments due to unfamiliarity with the instruments and also in my anxiety to rapidly cure my patients, I overworked the muscles.

Three of these patients were physicians who were irregular in attendance and the following history case will illustrate my mistake. A school girl, age fourteen, consulted me for headache whenever she used her eyes for close work. Vision 20-30, accommodation normal, adduction five degrees, abduction four degrees, and convergence (dot and line) only to sixteen inches. Orthophoria for distance, and exophoria near, slight hyperopia, correction of which gave no relief. She was given fourteen disciplinary treatments of internal recti muscles—one daily—giving from seven to eight lifts at each sitting and she progressed slowly up to the fourth sitting when she could overcome eleven degrees, but subsequently went back until at the fourteenth she could overcome but six. Treatments were then suspended. Six months later she was persuaded to try again and I began by giving only four lifts at a sitting and she progressed rapidly up to fifty degrees at the twenty-eighth treatment, and one month later she could overcome the same without practice in the interval.

The following school year she was able to use the eyes with comfort.

The experience with this girl and others previously, taught me that it is easy to overdo the exercises, and therefore we must be careful.

One other case taken at random exemplifies results of some fifty or more treated with satisfaction as my "follow-up" records show.

This girl had not only marked exophoria but right hypophoria as well. She was a school girl, age eighteen, and complained of blurring and running together of letters whenever she read; also with frontal headache accompaniment. She had been refracted elsewhere without relief. Subjective tests showed slight hyperopic astigmatism in right eye and low degree of hyperopia in left eye, with adducting power fourteen degrees and abduction thirteen degrees, right hyperopia six to ten degrees at different tests. She could converge only to sixteen inches and there was exophoria of nineteen degrees for distance. Disciplinary treatments were begun with the Hazen Kratometer, five lifts at each sitting—once daily for fifteen days—at which time the eyes recorded orthophoria for distance, adducting power of fifty degrees, and inferior turning of right of three and one-half degrees as against one degree when we began treatment, and all hyperopia had disappeared. Two years later she wrote me that she had had no further trouble since treatments, that she took extra school work the following year and soon discarded the glasses given her at the end of treatments.

This case is in marked contrast to the teachings that disciplinary treatment of the superior and inferior rectus muscle is of no benefit.

Prisms of one-quarter degree interval were used in the discipline of the superior recti and such must be used to get results with either the superior, inferior recti or the obliques.

My observations so far lead me to believe that young persons respond more readily to the treatments than do older persons. I seldom carried the exercise to exceed fifty degrees in adduction and this seems ample for reserve power for all necessary prolonged use of the eyes for close work. The woods are full of these sufferers who have exhausted both means and patience in a weary round consulting ophthalmologists, optometrists, chiropractors and other cults

without benefit. I find it difficult to persuade my patients—who are usually from some distance out of town—to stay long enough to get results. These people are disheartened, skeptical, and as it requires an average of twenty treatments—one each day—few feel willing to spare the time and expense of being away from home so long.

In the larger cities there is a lucrative field and a splendid opportunity for those who will carefully diagnose and treat these cases by gymnastic exercises, for here the patients can remain at home and go daily to the physician's office without extra expense or loss of time as in the country, and their gratitude is unbounded.

#### DISCUSSION

DR. H. A. BEAUDOUX, Minneapolis: This paper coming from Dr. James is of special significance to me as it must be to every one of you who knows the experience of the essayist in refractive work. Dr. James probably stands next to none in the State of Minnesota and perhaps many of the states in the Union as a refractionist. He has had the experience and patience to carry on this work for many years—to my knowledge for twenty-five years—and anything he may have to say on this subject can be considered with great authority and of great importance. He has already said that ophthalmologists have neglected the subject for the reasons he has given you. Patients are rather intolerant of the treatment, which is lengthy and tedious. Doctors get tired of working with patients perhaps for two reasons, one of which is because patients do not encourage the work, and second, because they are not willing to pay for it. However, I think the neurologist, if no other member of our profession, has appreciated the work which has been done on the eye muscles. Many cases of so-called neuroses or neurotics are not neurotics at all, but the nervous condition back of it is oftentimes due to muscular imbalance.

Dr. James has not mentioned one feature which I think he has overlooked and knows well enough about it, and that is, focal infection. It has a great deal to do with heterophoria. The foci of infection may be found in the nose and throat, or the ethmoid cells, but more particularly the teeth.

Not very long ago I had the case of a young man, 27 years of age, who complained of asthenopia and muscular imbalance. After looking over him carefully I decided that some of his teeth should be taken care of, and 14 degrees of hyperexophoria disappeared after the removal of fourteen teeth. Oftentimes these patients are misguided by the so-called physicians whom they consult for relief. Personally, my experience has been spasmodic. Every time I meet Dr. James I receive a new and better encour-

agement about it, and I have gone home thinking I had become somewhat indifferent about this condition.

Dr. James is to be congratulated on his persistence. Like Theobald of Baltimore, Stevens of New York, who have persistently hammered away at the subject, he has done a great deal of good.

#### THE PHYSICAL EXAMINATION OF THE NORMAL HEART OF THE CHILD\*

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On account of limited time I shall be unable to discuss in detail the anatomical and physiological peculiarities of the heart of the child, the knowledge of which is valuable in the physical diagnosis. In general, the heart of the child lies higher in the thorax than does that of the adult. It is also more horizontal and the apex beat is farther out. As the child grows older the heart falls downward and inward assuming, at about the seventh year of life, the adult topography, when the heart apex beat can be seen and felt in the fifth interspace inside of the mammillary line.

The actual apex beat in the normal child, is circumscribed to one space in the infant, about 2 cm. in diameter, and to 1 or 2 spaces in the older child. In the newborn it is rarely visible or palpable, while in the older child, it may be either seen or felt or both.

In the adult, the apex beat is formed only by the left ventricle, but in the child, especially in the infant, the apex beat is made up of about  $\frac{1}{2}$  of the right ventricle. This is due to the fact that the right ventricle, at birth, is as large as the left and remains relatively preponderant for from 3 to 6 months.

The intensity of the apex beat varies in different children and at different ages in the same child. The thickness of the walls of the thorax and whether or not the beat happens to be behind a rib, are factors which influence the intensity. The change of the apex beat is greatly influenced by the change of position of the body. It moves as much as 2 cm. to the left or to the right respectively, with a bodily change. If the child is lying on the right side, the apex

\*Read before the Minnesota State Medical Association, St. Paul, October, 1920.



beat may be entirely impalpable on account of the overlying lung. Pushing the body forward will sometimes make an invisible or impalpable apex beat visible or palpable. Deep expiration may bring out the beat more prominently because the lungs become retracted. Psychic or physical stimulation to cardiac activity usually intensifies and diffuses the apex beat.

In general it can be said that in the first half of childhood the apex beat lies in the fourth, or fourth and fifth, and in the second half of childhood it lies most often in the fifth space. Up to three years it is never more than 2 cm. outside of the nipple line and after that, never more than 1 cm. These can be used as normal limits. If the apex beat is outside of these limits, one must always be suspicious of an abnormal heart, providing that the nipple is not in an abnormal position.

#### PERCUSSION

Percussion as a method of physical diagnosis is not sufficiently exact. It involves the personal equation of the examiner, what he considers the first change of tone, the conditions under which the examinations are made and the technique he employs in his percussion.

The results obtained from percussion are affected by many varying factors in a growing child, viz: the position of the child while being examined, the size and shape of the thorax, the vibrations of the walls of the overlying lungs, the skeletal characteristics of different children of the same ages, and the difference of children of the same age in body weight and in body length.

It is always best to percuss the back first. One should attempt to carry out the examination without the child being aware that anything unusual is being done. A very delicate stroke is necessary because in the young, on account of the thinness of the chest walls, the tone produced is very easily modified by the surrounding tissues.

In the adult absolute dullness may give quite accurate results, but in the child it is practically impossible to elicit accurately the uncovered portion of the heart.

The absolute dullness in the nurseling is bounded above by the third rib; the right border is just to the left of the sternum; the

left border is precisely at the nipple line. From 2 to 4 years the borders are a little lower and slightly over to the right, the upper border falling to the third space. From 4 to 12 years, there is still another drop, the base of the heart descends to the level of the fourth rib; the left border moves from the mammillary line to 1 to 2 cm. within it, and the right border moves from 1 to 2 cm. to the right of the midsternal line.

In the adult, the left border is always within the nipple line, whereas in the young child it is usually at or outside of this line. In the adult, the sound at the upper part of the sternum is always clear; in the period of infancy, it may be impaired on account of the thymus. In general 2 cm. more or less than the figures given above can be allowed for a normal variance. Any increase in size to the left indicates an enlargement of the left ventricle. An increase to the left and upward indicates enlargement of the left auricle mainly, and to a lesser extent the left ventricle. If percussion shows increase to the left and downward, the left and right ventricles are involved, and lastly, enlargement to the right involves mainly the right auricle and only slightly the right ventricle.

#### AUSCULTATION

Auscultation is the most useful and reliable of all clinical methods in the diagnosis of heart diseases of children.

The success of an auscultation depends as much upon the patience and the resourcefulness of the examiner as upon his skill in physical diagnosis. In the newborn, the heart rate and the respirations are so rapid that it is very difficult, especially if the baby cries, to hear the heart sounds clearly. However, usually during the forced apnea, one may hear several cycles with sufficient distinctness to determine whether or not they are normal. Sometimes it may be possible to hear the sounds more clearly over the scapula than over the precordium, because of less interference from respiration.

At birth the sounds are tic-tac in character as in the fetus. This usually disappears in a few days, although sometimes persisting for a week. At this time one cannot observe any difference in the tone of the sounds. At about

the end of the second year, the first sound becomes booming, louder than the second, and remains so throughout all childhood becoming more accentuated at about puberty. The sounds are usually louder in boys than in girls. They are louder in standing posture than in sitting, and louder in sitting position than in lying.

Pressure with the stethoscope changes the character of the tones considerably. The inhibitory mechanism controlling the heart is weaker in the child than in the adult, therefore the rate of the heart and the quality of the sounds is more easily influenced. Crying, forced expiration, fever however slight, cause accentuation of the sounds. In anemia and neuroses, the sounds are often louder and give what is known as the "metallic clique". In chronic diseases of the lungs which cause a disturbance of the pulmonary circulation, the pulmonary sounds are usually louder (except in pulmonary stenosis) over the tricuspid area and the apex. A slapping sound at the apex, as in the adult, is very suggestive of a mitral stenosis.

The second sound at the tricuspid area is also accentuated in all conditions where there is pulmonary or bronchial involvement as in pertussis of long standing, in asthma, and in congenital heart disease. The aortic sounds are very rarely accentuated in children. The aortic sounds are always weaker than the pulmonary tones in the normal heart, and since their accentuation depends upon an increase of peripheral blood pressure, and since diseases of blood vessels are extremely rare, accentuation of the aortic sounds is very rare. All the sounds are generally diminished in myocarditis and in the terminal stages of decompensated hearts.

The gallop rhythm is caused by an abnormally stimulated heart activity. It is physiologic in the newborn giving the tic-tac character to the tones. This phenomenon is rather frequent in children whenever the rate is greatly increased. It occurs in fevers quite often. However, the true gallop rhythm which is always indicative of myocardial involvement, is rare in children. It occurs most frequently in diphtheria, and in decompensated hearts with acute dilatation. It is always a grave omen under these circumstances.

Impurities, unevenness, roughness and split-

ting of the sounds especially the first are much more frequent in the child than in the adult. These are usually found in perfectly healthy children. They are too often diagnosed heart murmurs and treated as heart diseases.

#### MURMURS

So much has been written on the subject of murmurs, so many different explanations have been given for their causation, that after reading the literature, one is bewildered in the attempt to apply all the various opinions and theories to physical diagnosis.

At birth and for the first few weeks, a heart murmur is quite common. It is practically always associated with a patent foramen ovale or a patent ductus arteriosus. With physiological changes, these murmurs disappear.

The vast majority of murmurs heard during the period of infancy are congenital in nature. They are often very loud, they may be musical and harsh. They may be heard all over the chest and back and even over the abdomen. The most common site for this class of murmurs is at the left of the sternum over the second and third intercostal spaces. This is usually the point of maximum intensity, from which they may be transmitted in all directions. Congenital heart murmurs are extremely variable on account of the involvement of more than one structure of the heart.

#### ACQUIRED MURMURS

As in the adult these murmurs are the result of inflammation of the endocardium. They occur only rarely in infancy. They are usually the end results of one or more attacks of tonsillitis or rheumatism. They of course can be caused by any other acute infection. They are frequently best heard at the apex and transmitted most often towards the axilla and the back. They are sometimes musical, rarely harsh, and although loud not so loud as the congenital type. The systolic murmur is by far the most common in acquired heart disease. It may or may not entirely replace the first sound at the apex. The diastolic murmur which is very rare in the child is always pathological and usually is a part of a double murmur.

#### NON-PATHOLOGICAL MURMURS

This form of murmur is much more frequent in the child than in the adult and has been a

cause for much dispute and discussion. This group includes the accidental, the cardiopulmonary, the anemic, the compression, and the atonic.

I have selected for discussion 26 children from 6 to 12 years of age in whom I found what I considered non-pathological murmurs. I arrived at this conclusion by reason of the normal size and shape and position of the heart obtained by percussion, the absence of any signs of heart disease discoverable with the roentgen ray and the electrocardiograph.

Authors have reported very severe cases of anemia without any murmurs, and on the other hand children with normal hemoglobin may have marked murmurs, so that anemia as a cause of bruits is only incidental. Two of these cases, only, had a hemoglobin of less than 80 per cent.

#### CARDIOPULMONARY

Of the above series only 4 presented certain characteristics which justified the diagnosis of cardio-pulmonary murmurs. The murmurs were systolic and heard best at the left of the sternum at about the third interspace rather than at the apex, as is claimed by some, and were markedly decreased and often absent upon holding the breath. The murmurs changed with the alteration of position but I found no constancy in the change of the murmur with the alteration of position as is claimed by some observers.

#### ACCIDENTAL MURMURS

Fifteen of these cases may be considered as accidental types. There were absolutely no signs of heart disease and the roentgen-ray shadows and the electrocardiograms were normal. Some were in so-called nervous children, but it could not be seen why nervousness should, as some think, cause this type of murmur. The murmurs were all systolic in time, soft, superficial, usually losing their intensity before the end of the first sound. In all cases the murmur was heard at the pulmonary area and over the apex. In only 3 cases was it heard only at the apex. They were all well localized, only in 1 was there any transmission into the axilla. The belief that these murmurs are heard best while lying and tend to disappear when erect

cannot be substantiated by the above observations.

In the majority of cases the murmur is the least important sign in the differential diagnosis between organic and inorganic heart disease. The only constant characteristic of these murmurs is their inconstancy. After a careful survey of all the important literature on this subject, it would seem that a voluminous classification such as above mentioned is unnecessary and impractical. For all practical purposes it is sufficient to divide murmurs formed in children into the organic and the non-organic; if a murmur is not associated with enlargement of the heart or other signs of heart disease, congenital or acquired, the murmur should not be given serious consideration, and the child should be advised to lead a normal life in every respect.

#### VENOUS HUMS

The venous murmur or hum is of very frequent occurrence in normal children. It is heard most frequently in the school age, rarely during infancy and it is influenced by position and by pressure with the stethoscope. This bruit is heard through the entire heart cycle, over the internal jugulars, sometimes loud and harsh, at other times low pitched and soft. It is loudest at the inner third of the clavicle sometimes on one side, sometimes on the other. The murmur is almost always diminished or disappears in the prone position and is usually accentuated by moderate pressure with the stethoscope.

Eustace Smith has described a venous murmur which he claims is heard in early tuberculosis over the second interspace usually to the left of the sternum, sometimes also to the right. He believes this is produced by the pressure of enlarged bronchial glands on the left innominate vein. I have examined many early cases of tuberculosis for this sign and was unable to find it with any constancy. On the other hand, I found this phenomenon in a few instances in association with the venous hum in normal children. I believe it to be of no diagnostic value.

Arterial murmurs are always pathological in children. They are heard best at the angle of the jaw or inner edge of the sternocleidomastoid muscles. A pressure murmur can be demonstrated often in normal children by applying

a stethoscope with some force over the larger arteries. A systolic murmur also is heard very frequently over open fontanelles. This is especially common in rickets during the first year of life. Arterial murmurs over the vessels of the neck are very common in congenital heart disease.

#### DISCUSSION

DR. W. R. RAMSEY, St. Paul, Minn.: I think Dr. Seham is to be very highly congratulated on his paper because there has been little done on the normal heart of the child. A good deal of our work has, of course, been done on the heart of the adult. There has been a great tendency on the part of physicians to regard children as simply immature adults, but we must get away from the idea that children are simply immature adults and that we can apply the same rules to children as to adults in a relative way. We must stop saying that a child can take one-fifth the dose of the adult because it is one-fifth the size or one-fifth the age. It is an entirely different matter, but it has not been brought out very well. One English author has written a very good little book on that, Dr. Sutherland, but Dr. Seham brings out some very important points which he did not emphasize.

I wish to emphasize that the relative position of the heart is changed a great deal by any slight deformity of the chest and since so many children have rickets we do find marked deformity. These positions that Dr. Seham has given you will be modified as there is any modification in the chest wall.

I also wish to emphasize, as Dr. Seham mentioned, the very great frequency of heart murmurs in children, many times of no serious moment. It is very difficult to say when they are and when they are not serious and it is important to be very guarded in the prognosis, because I have watched many that I thought were serious in the beginning, but after a while the great majority have disappeared. I do not know to what they are due. To show how one may be mistaken, a few days ago a boy came back from the seashore where he had been spending the summer. I had never found a murmur but he had a little intestinal upset, and I saw him for that and on listening to the heart in the course of the examination I was amazed to hear a loud systolic murmur. They boy had been swimming a great deal. It looked as if he had, probably, an aortic stenosis, so I told them he had this murmur, but that we would not say much about it for it might disappear. Sure enough, after two or three days in bed I found no murmur at all.

I consider this a very important and timely subject and think Dr. Seham covered it very well.

DR. E. J. HUENEKENS, Minneapolis, Minn.: I wish to thank Dr. Seham for this important paper. I hesitate even to discuss it because Dr. Seham has made a more extensive examination of the heart and particularly of electrocardiography in children than anyone in the country. I was privileged to hear a paper last

night by Dr. S. M. White on the unimportant heart murmur, particularly the hemic, but it might have been on the unimportance of murmurs in any part of the heart.

I wish to emphasize that we can pay too much attention to heart murmurs and make invalids of children who should be up and about playing. The same is true of murmurs heard shortly after birth. They may disappear very quickly and we should be very careful about making diagnoses of congenital heart defects in children soon after birth. They are apt to disappear promptly and leave no trace.

#### SPINA BIFIDA\*

#### A REVIEW OF 187 CASES, INCLUDING THREE ASSOCIATED CASES OF MYELODYSPLASIA WITHOUT DEMONSTRABLE BONY DEFECT.

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The condition of spina bifida never fails to arouse the physician's interest, since it puts him directly face to face with a most perplexing biologic phenomenon. Although in most instances no diagnostic acumen is required for its recognition, occasionally a problem of extraordinary difficulty is presented, particularly in the occult variety of the disease in which the onset of symptoms may be delayed until the declining years of life.

Spina bifida is one of the most common deformities, making up one-sixth of all monstrosities (Chaussier); it occurs once in from one to two thousand births. Tulpius, in 1641, named the condition spina bifida; the Greek designation, *rachischisis*, is customarily reserved for the most marked type of the defect, in which the entire medullary canal fails to close.

The defect may appear as a spina bifida cystica or as a spina bifida occulta; the majority are of the cystic type (Fig. 1). Subdivision of the cystic type depends on whether the walls of the tumor include only the membranes of the cord, that is, a meningocele (Fig. 2), or whether they include both the membranes and the cord, a meningomyelocele; the central canal of the cord may be dilated, when the growth is termed a syringomyelocele, or the cord may be turned completely

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inside out, when the sensory roots come to lie laterad and ventrad to the motor roots. The nomenclature is not uniform. Because of this and because of the difficulty of determining the exact relations by clinical means alone, I have not attempted to classify the cases further than by evidence of accompanying cord involvement, which was found in 67 per cent of the cases (Fig. 1).

A very important condition allied to spina bifida, although it represents only a fraction of such cases, is an analogous developmental defect of the spinal cord, that is myelodysplasia without demonstrable bony defect. It is important from both the biologic and the clinical standpoints.

Spina bifida is usually posterior, but may be lateral; it occurs anteriorly, (Budde), although very rarely, and then it has an altogether different embryologic significance.

#### THEORIES OF THE ETIOLOGY

The causes for the development of spina bifida and the manner in which it develops have been the object of a great deal of speculation and research, but are still unknown for the most part. In the embryo closure of the neural canal is completed by the beginning of the third week, the upper and the lower ends, where the spina bifida usually occurs (Fig. 1), being the last to close. Whatever the cause of the defect may be, it seems to have been active prior to this. The theories of adhesions, either amniotic, resulting from amniotites with hydramnios, or lack of separation of the skin from the medullary plate (Cruevilhier, Ranke), have largely been displaced. The assumption of abnormal bending in fetal life (Chaussier) hardly brings the solution nearer.

One of the oldest theories, strongly championed by Morgagni in 1779, rejected by most writers since von Recklinghausen's comprehensive dissertation on spina bifida, in 1886, and recently rediscovered and espoused by numerous writers, is the theory of hydromyelia. According to this theory the choroid plexus, activated, perhaps by a hormone, secretes such a large quantity of spinal fluid that it either prevents union of the medullary folds or ruptures them after union has taken place. Interference with the absorption of spinal fluid is advanced as the alternative mechanism. The rapid accumulation of fluid

then is given as the primary cause; the resulting cyst is interposed as a bulging mass between the lateral mesodermal structures, preventing the approximation and fusion of the lips of the medullary groove. One of the main supports of this theory lies in the fact that spina bifida is often associated with hydrocephalus, which is rapidly made worse or, if not already present, may rapidly be produced by operative closure of the spinal defect. The assumption of an excessive amount of spinal fluid obviously depends on the further assumption that the choroid plexus is secreting fluid at this early embryonic period. This hypothesis seems inadequate when the whole problem is considered; one of its most serious objections is the fact that the choroid plexus does not begin secreting fluid until about the tenth week, 2.4 mm. embryo, (Monakow), whereas all writers agree that the spina bifidous deformity is produced no later than the third week. Further, the cases in which there is a failure of the entire neural canal to close certainly represents a more serious type of the same fundamental defect and must accordingly be explained on the same basis; it seems highly improbable that the amount of spinal fluid secreted is so immense that the entire canal, from its cephalic to its caudal ends, would be torn open or union prevented throughout by the flow of the choroidal secretion. Complete absence of the cord, or amyelia, which accompanies many of these severe types (Schmaus and Sacki) must also be explained by a more comprehensive theory. Mention of micromyelia, diastomyelia, and diplomyelia, which occur with spina bifida and without it, would still further embarrass the theory. It is also irreconcilably at variance with the observation that the portion of the spinal cord involved lacks all evidence of pressure myelitis, with its disintegrating nervous tissue; on the contrary, it is seen to have remained at a standstill in its embryonic development, with embryonic nerve cells and embryonic blood vessels, as the area medullovasculosa (von Recklinghausen). Associated defects such as harelip, cleft palate, and club feet, are considered by reconducite inference, to be the results of pressure on the nerve centers. While it must be admitted that the added area of absorption supplied by the cyst often prevents the occurrence of hydrocephalus, it would seem more reasonable to suppose that the faulty absorption of spinal

FINDINGS OTHER THAN X-RAY, NOTED IN 187 CASES OF SPINA BIFIDA  
(Males 102; females 85)

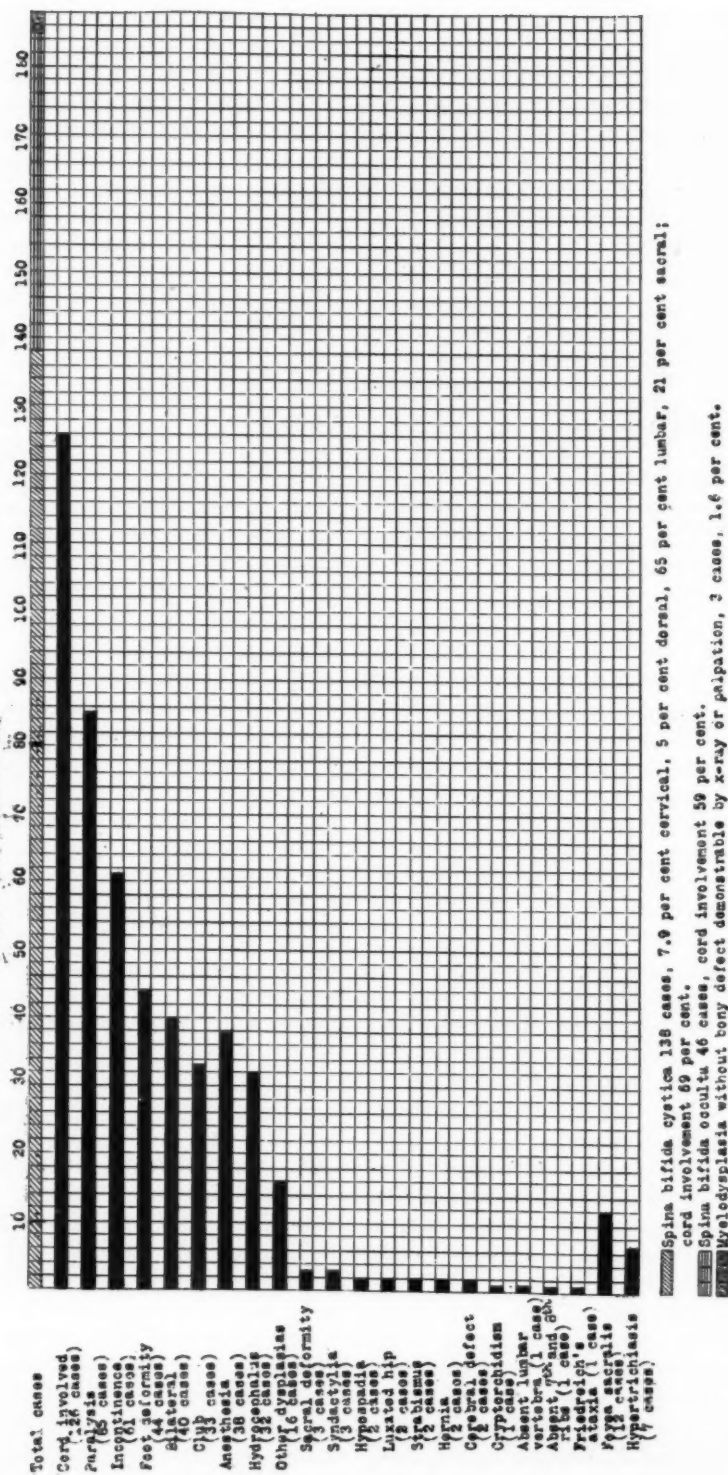


Fig. 1. Findings other than x-ray in 187 cases of spina bifida.



Fig. 2. (Case 329299) Large meningocele without any demonstrable involvement of the spinal cord.

fluid may also be based on some developmental defect. An associated cardiovascular defect has been suggested as a possibility.

von Recklinghausen believed that spina bifida is primarily due to a failure of the mesodermal envelope of bone and dura to approximate; he looked on the ectodermal dysontogenesis as secondary. The fact that a myelodysplasia of this type may occur without defects in the bone contraverts this theory; it suggests that the defect may be primary in the medullary plate. The types of spina bifida cystica and spina bifida occulta not accompanied by defects in the nervous system argue for the reverse. The necessity for making one primary and the other secondary is not apparent. Whatever the exact mechanism may be, it does not complete our search for the more fundamental process in which we are primarily interested.

There is much evidence against assuming that the basis is germinal, or developmental, and such cause has been generally discarded. I do not believe that this is altogether justified. Thus the presence of developmental defects in Case A286355 (Table 1), in which the closely related defect of enuresis and sacral dimple were transmitted to six persons on the male side, through three generations, is clearly an instance of her-

edity. Case A213465 and Case A259846, in which the same defect appeared in siblings, do not furnish conclusive evidence, since maternal environmental factors might have been just as potent and quite as likely as developmental factors. On the whole, the hereditary element hangs on a very tenuous thread; it must be assumed for occasional cases, but these are not numerous enough to argue for its acceptance as the sole cause.

#### EXPERIMENTAL PRODUCTION OF SPINA BIFIDA AND OTHER ANOMALIES

Recent work among biologists cannot be disregarded as some writers are disregarding it simply because it has been carried out on lower forms of life. The experimental production of spina bifida by modification of the environmental medium has taught us a great deal. A brief review of this evidence is profitable. Probably the most striking demonstration of the importance of environment in the production of spina bifida was that produced by Hertwig, in 1896, who subjected the axolotl, a salamander, to different concentrations of sodium chlorid solution. He found that a 0.5 per cent solution had no effect, a 0.6 per cent solution produced monsters in 50 per cent, while 0.7 per cent solution resulted in development of spina bifidous monsters in every case. Stockard, using *Fundulus heteroclitus*, the common minnow, produced spina bifida by using magnesium chlorid. Cyclopes could be produced in at least 50 per cent of cases, which was somewhat more frequent than spina bifida. It was also demonstrated that alcohol, ether, and the alkaloids could be used with similar results.

In order to demonstrate the applicability to man of these factors of monster production, Werber used substances produced in the human metabolism, namely butyric acid and acetone. He exposed *Fundulus heteroclitus* in the two, four, eight, and sixteen cell stages, to the action of 1-12/1-14 gm. molecular solution of butyric acid in sea water, from fifteen to twenty hours; he produced a great variety of monstrosities, the extreme defect being the development of only an eye or an ear, the rest of the embryo failing to appear. Higher percentages of acetone killed the embryos, while lower concentrations resulted in the development of monsters. Werber concluded that faulty maternal metabolism

Table 1

HEREDO-FAMILIAL DEVELOPMENTAL DEFECTS PRESENT IN TEN (5.5 per cent) OF 187 PATIENTS HAVING SPINA BIFIDA

Case	Chief Complaint or Defect of Patient	Relative	Character of Defect of Relative
A213465	Two cervical cysts, one dermoid	Brother	Spina bifida; died
A259846	Incontinence	Sister	Spina bifida, discharging sinus
A133521	Hydrocephalus. Paralysis of legs	Brother	Hydrocephalus
A318453	Spasms in legs	Sister	Mute
A 75729	Paralysis of legs	Grandmother	Deafmute
A 83303	Speech defect and athetosis	Brother	Speech defect and athetosis
A286355	Speech defect, webbed toes Mentally deficient, spastic	Father Paternal uncle Paternal uncle Paternal nephew Paternal grandfather	Speech defect, enuresis, sacral dimple Speech defect, enuresis, sacral dimple Speech defect, enuresis, sacral dimple Speech defect, enuresis, sacral dimple Speech defect, enuresis, sacral dimple
A281371	Incontinence, webbed toes	Sister	Enuresis
A223921	Incontinence, dislocated hip Club-feet	Father Mother	Sacral dimple, flat-feet Hernia
A239329	Occulta, unrelated complaint	Child	Cleft palate

might well be the underlying cause of dysontogenesis. Disastrous maternal effects of diabetic patients are well known. Keibel and Mall found that the chorion of nearly all monsters had been the seat of inflammatory processes which in time might well have interfered with normal metabolism. The frequent association of hydramnios makes this all the more probable.

Chemical methods are not the only ones by which monsters have been produced artificially. One of the other simplest devices is a modification of gravitational forces on frog's eggs. Simply turning upside down (Conklin) frogs' eggs in the two-cell stage may cause the development of double-headed or double-bodied monsters. A redistribution, by centrifugalization, of the heavier elements of the eggs constitutes another method. In the ascidian (sea squirt) eggs, in which different kinds of protoplasm give rise to different organs and tissues, this rearrangement may result in marked dislocation of organs. That the problem is complex is shown by the fact that some varieties develop normally in spite of this artificial rearrangement (Morgan). Lewis adopted the remarkably simple method of destroying different portions of the eggs of *Fundulus heteroclitus* by operation-needling, and so forth,

and demonstrated that the organs predetermined in the portion of the egg destroyed did not develop. He could thus produce a developmental defect in any portion of the body he desired. Kellicott found that subjecting the eggs of *Fundulus heteroclitus* to a temperature of the average household refrigerator, for a few hours or days, sufficed to produce every variety of defect.

That physicochemical action may produce developmental defects was demonstrated by Bardeen, who exposed both male and female frogs to the x-ray for one hour, prior to fertilization. He learned that exposure to the x-ray of the ovum or the sperm sufficed to influence the subsequent development of the eggs in such a manner that marked abnormalities, including spina bifida, resulted. Baldwin produced spina bifida in frogs by exposing a given part of the egg to the action of the ultra-violet ray.

The mechanism by which various factors influence the developing organism is also disputed. I can only refer to these briefly. Mall<sup>11</sup> assumed that nutritional factors *in utero* resulting from diseased fetal members underlie monster production. Werber postulated the theory of blastolysis, according to which a part or wedge of the germ substance is destroyed, resulting in



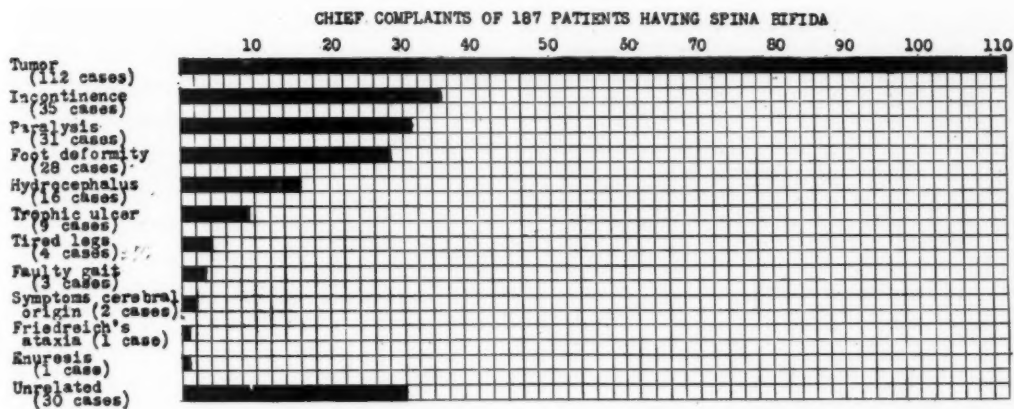


Fig. 3. Chief complaints of 187 patients having spina bifida.

anomalous fusion or dispersion of the part split off. Stockard believes that he has proved, by the use of magnesium with its well known anesthetic or inhibitory action, that an inhibitory action is responsible. Kellicott, espousing the hypothesis of disorganization, believes that this must take place before differentiation by gastrulation, through interference with the organization of the fertilized ovum. The discovery of the deleterious action of the x-ray and radium on the sperm, prior to fertilization, added another complication, since it proved that an abnormal character of the gametes may in some instances suffice to produce the defect.

von Recklinghausen's demonstration that the area medullovasculosa contains elements retaining early embryonic characteristics is of fundamental importance and prohibits the acceptance of the current theories, in the strictest sense, as an explanation of the larger group of cases not dependent on hereditary factors; or is it possible that lack of abnormality of function and metabolism, secondary to the apparent isolation of these elements, in the area medullovasculosa suffices to explain their embryonic appearance.

In view of the foregoing clinical observations and the facts adduced through experimental methods, it seems that spina bifida cannot be explained on the basis of any single factor, but by one or more of the following causes: abnormal character of the gametes or mechanical, chemical or physico-chemical factors influencing the embryonic rudiments, either before or after differentiation; the mechanistic action of accu-

mulated cerebrospinal fluid could act only as a secondary cause. A conception as broad as this seems to destroy all semblance of a theory; indeed, any precise formulation of a theory which does not take all these factors into account would be dogmatic, premature, and untenable at the present stage of knowledge.

#### CLINICAL DATA

The findings and usual symptomatology of spina bifida have been adequately and repeatedly described in the literature. Several features however, call for correction or deserve special emphasis. Figure 3 illustrates the chief complaints for which the patients came to the Clinic and Figure 4 the order of appearance with regard to the age of the patients.

The prevalence of spina bifida occulta cannot be determined easily and the estimate of 24.6 per cent in Figure 1, is probably too low, since many persons unwittingly carry about this defect and suffer no ill effects. Roentgenologists believe the condition to be so common as to be considered almost a normal variation which usually seems to have little or no bearing on the cause for which the patient was referred for examination. Reflex disturbances, such as absent tendo-achillis reflexes, faulty contour or slight asymmetry in the development of the calves or buttocks, *pes cavus*, and hammer toe, have not been charted, although they are important and often find their explanation in spina bifida occulta, best demonstrated by the x-ray (Figs. 5 and 6). It must be borne in mind that the incomplete development of bone in children under

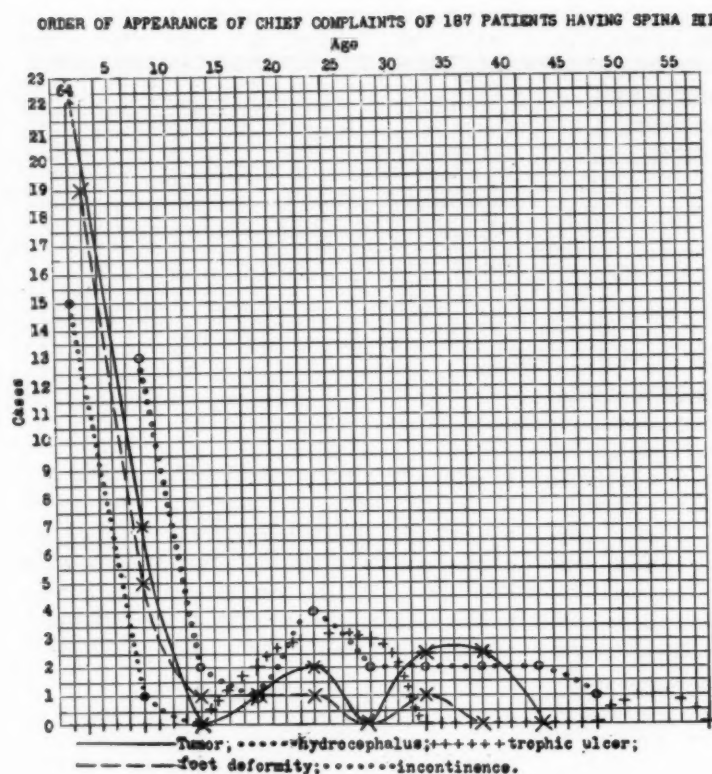


Fig. 4. Order of appearance of chief complaints of 187 patients having spina bifida. (Case 261454.)



Fig. 5. (Case 261454) Roentgenogram of spina bifida of the lumbar region. Note the oblique position of the posterior spinous processes.

nine years of age makes their examination by the x-ray unsatisfactory.

Hypertrichiasis (Fig. 7) is, on the whole, not common. Virchow first pointed out the usual association with spina bifida. The Atavistic theory, assuming a reversion to the tail-bearing animals was thus replaced. Von Recklinghausen mentions the possibility that persons having this defect with associated *pes equinus*, so common in spina bifida, supplied the basis for the mythologic conception of the satyr and the early Christian visualizaion of the devil, the lower part of the body equine and the upper part human. According to Tellman, thirty-eight of forty-two cases (90 per cent) of *hyper-*

*trichosis partialis* were associated with spina bifida. Whether this is due to stimulation from chronic inflammation, as Virchow assumes, is uncertain; von Karwowsky's patient, who developed a hypertrichiasis about the elbow following gonorrheal arthritis, furnishes supportive evidence.

In about 8 per cent of cases the tumor is located in the cervical region; in Figure 8 are shown two spina-bifidous cysts; the lower contained a dermoid.

The sacral dimple, *fovea sacralis* (Fig. 9) is a very common defect. Cramer found it in 40 per cent of two hundred infants. It usually disappears by the age of 12; when persistent, it signifies a developmental sacral defect.

Deformity of the feet, usually club-foot, is one of the most common deformities and may be the result of muscular paralysis. This, however, by no means explains all cases of club-foot. As an instance of hereditary transmission Tub-



Fig. 6. (Case 316979) Roentgenogram of spina bifida occulta of the upper thoracic area.

by cites Little's case, in which there was transmission of club-foot through the male side for four generations. Club-foot is usually regarded as a developmental error on the same basis and of equal significance with the spina bifida. The theory of the fetus' prolonged retention in a deformed position in the uterus seems well disproved by the occurrence of club-foot in extra-uterine gestations. Peltsohn, whose records unfortunately were destroyed in the war, is of the opinion that club-foot, in the majority of cases, is associated with spina bifida occulta. It was present in the last eight cases which he had seen. Its presence should always be suspected in patients in whom there is a recidivation following operative correction.

The question of congenital dislocation of the

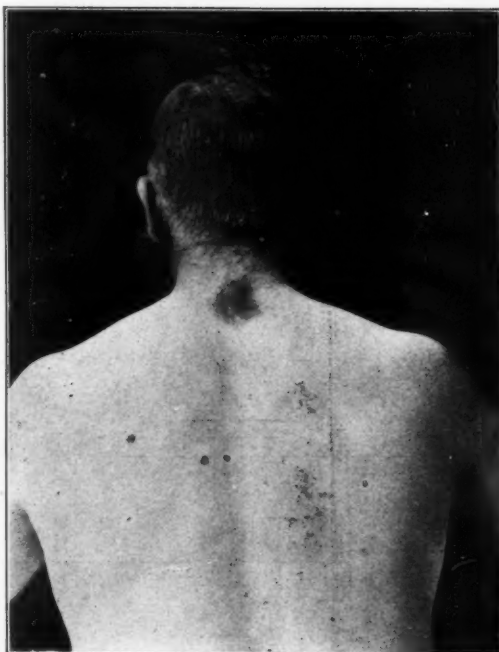


Fig. 7. (Case 280358) Hypertrichiasis over a spina bifida occulta.



Fig. 8. (Case 213465) Double spina bifida cystica in the cervical region. At operation the lower cyst was found to contain a dermoid.



Fig. 9. (Case 284689) Sacral dimple (fovea sacralis), a very significant defect in spina bifida.

hip has gone through a similar dispute; Lucke insisted that gluteal paralysis is primary, and Joachimsthal that it is simply another expression of multiple defects.

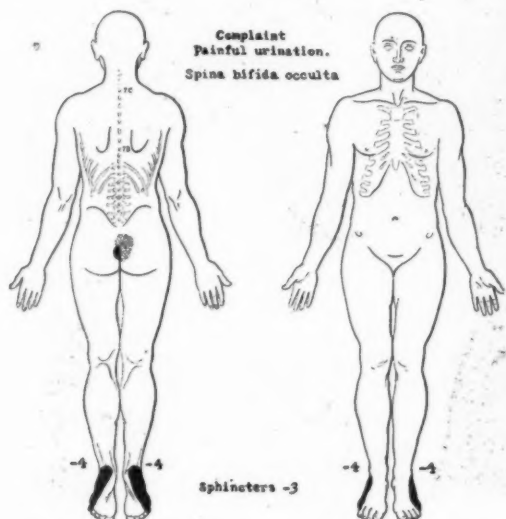


Fig. 10. (Case 263683) Slight degree of sensory disturbance in a case of spina bifida occulta. The perianal distribution is particularly noteworthy.

The paralysis of the muscles involving the lower extremities is usually flaccid. In one of our cases the paralysis of the upper extremities was flaccid and of the lower extremities spastic. The defect in this case was located in the cervical region. In one case a diagnosis of progressive muscular dystrophy had been made and a grave prognosis given. In 5.8 per cent of the cases the paralysis was spastic.

In order to get a better idea of the relative prevalence of muscular paralysis, sensory disturbance, and incontinence, than is possible in young children, forty-nine patients more than five years of age, excluding those with spina bifida occulta (26 per cent) without involvement of the nervous system, were selected and studied as a group. About 84 per cent of the group had evidence of cord involvement. Sphincter disturbances were the most common; they were present in 71 per cent of the patients and constituted the only evidence of involvement of the cord in

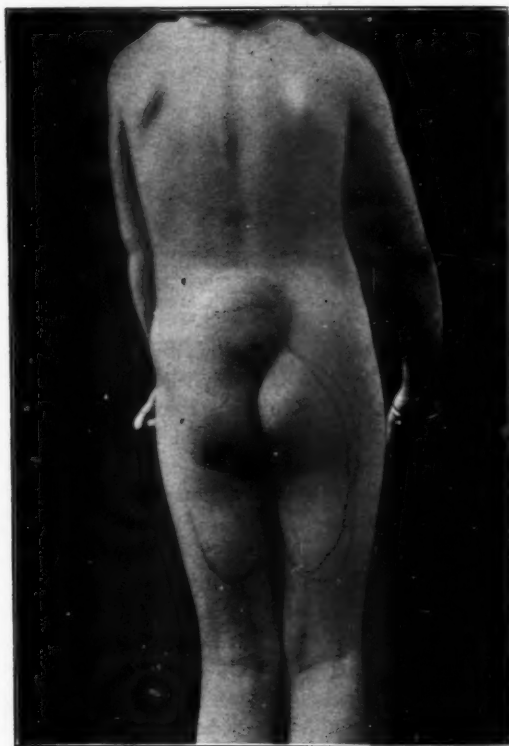


Fig. 11. (Case 268003) The patient's only complaint was incontinence. The area of complete loss of the sensibilities of touch, pain, and temperature is enclosed in the line.



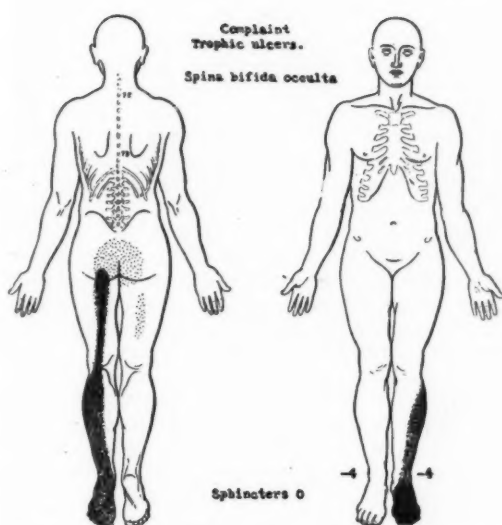


Fig. 12. (Case 310701) Sensory disturbance in a patient who complained of trophic ulcer. No disturbance of sphincteric control.

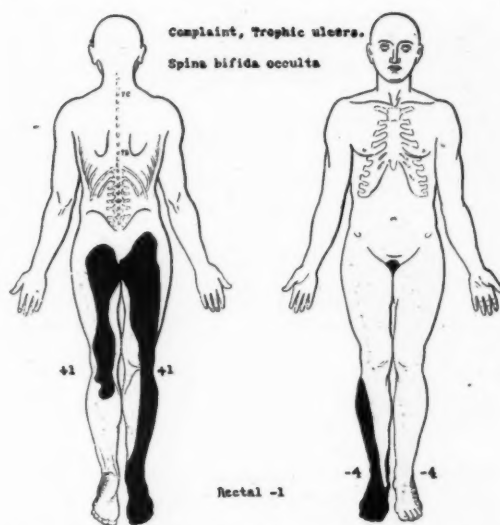


Fig. 13. (Case 240447) Loss of sensation in a case of spina bifida.

14 per cent. Motor paralysis in 53 per cent was the next most frequent finding, and furnished the only evidence of cord involvement in 6 per cent. Sensory disturbances were present in 45 per cent, but in no instance occurred independently. They may be very slight, as in Case 263683 (Fig. 10), and because of their location, easily overlooked.

Incontinence (Fig. 11) is common and while it is not discovered early it soon becomes one of

the leading complaints (Fig. 1); it also may develop later in life, even if the sphincter functions were formerly normal. The association of enuresis and spina bifida has been repeatedly emphasized. Enuresis was noted in only one case in our series, although it was noted a number of times in the family histories of the patients. Peritz found 68 per cent of spina bifida occulta in twenty-two adults with enuresis, and 35 per cent of spina bifida occulta in twenty-two

#### TARDY APPEARANCE OF SYMPTOMS AND PROGRESSIVE LOSS OF FUNCTION PRESENT IN 14.4 PER CENT OF PATIENTS HAVING SPINA BIFIDA

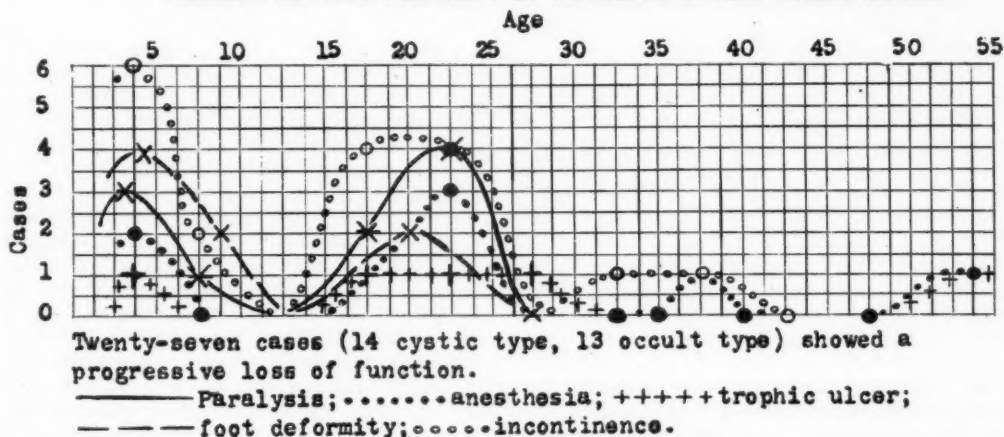


Fig. 14. Tardy appearance of symptoms and progressive loss of function in 14.4 per cent of patients having spina bifida.

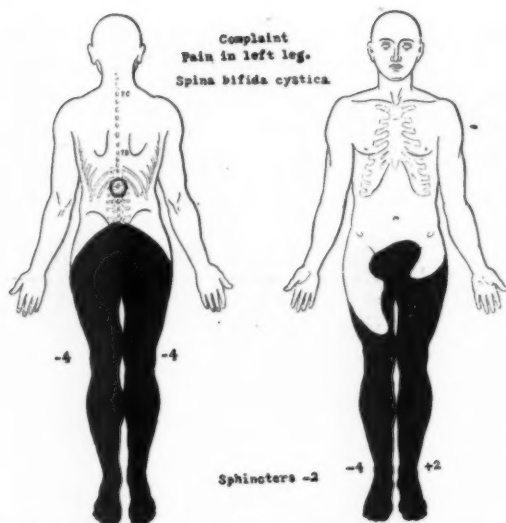


Fig. 15. (Case 264359) Loss of sensibility to touch, pain, and temperature in a case of spina bifida.

children with enuresis. Fuchs coined the term myelodysplasia to explain this relationship. He found associated *pes planus* in 80 per cent of patients with enuresis. The condition is explained on the basis of a paretic internal sphincter (Spieler) or of an anesthetic urethra (Schlesinger). The prominent psychic factor could be explained easily in either case.

All the trophic ulcers noted in the feet ap-

#### OPERATIVE RESULTS IN FIFTY-SEVEN CASES OF SPINA BIFIDA

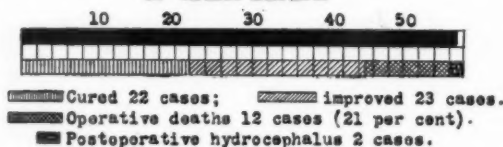


Fig. 16. Results of operation in fifty-seven cases of spina bifida.

peared after the fifteenth year, as Figure 4 indicates. One patient had been treated for a long time for tuberculous arthritis.

#### DISCUSSION

**Case A310701.** Mr. D., Aged 55, came to the Clinic March 30, 1920, complaining of a discharging sinus, which had appeared over the left fifth toe twenty-two years previously. The toe was amputated after one year, but the trouble continued, and four years later another ulcer developed over the left heel, which discharged continually. About this time the patient discovered some anesthesia of the left foot, and loss of sexual power. Three years before examination a third sinus appeared over the head of the fifth meta-

tarsal bone, and two years later fibrillary tremors in the left calf.

Examination revealed a slight general diminution in power of the left limb, no atrophy, but marked fibrillation. The tendo-achillis reflexes were absent. Sensory disturbance for all qualities of sensation were noted (Fig. 12). Sphincter control was normal. A sacral dimple was found and a roentgenogram showed a spina bifida occulta.

**Case A282791.** Mr. E. C. J., aged 19, presented himself August 1, 1919, complaining of an ulcer over the buttocks of one and one-half years' duration. He had never had normal sensation above his feet and had always suffered from enuresis, and three years before the condition had become aggravated.

On examination it was found that both legs below the knees were completely paralyzed; this had led to a diagnosis of infantile paralysis. Internal rotation of the right leg could not be obtained, the abductors of the thigh were very weak, and the quadriceps slightly weak. The left patellar reflex was absent on reinforcement, the right was normal. Both tendo-achillis reflexes were absent. Sensation for all qualities was markedly impaired over the saddle area and the feet. Control of the bladder was lost almost completely, and the anal sphincter was relaxed greatly. Trophic ulcers were present over both buttocks. Spina bifida occulta, involving the fifth lumbar and the sacral vertebrae was demonstrable by palpation and by the roentgen-ray.

**Case 240447.** Mr. N. K., a boy aged 16, came to the Clinic July 30, 1918. He had an ulcer of the right foot of four years' duration. Two scraping operations had been performed on the ulcer, one four years before, the other one year. He had had great difficulty in controlling his urine until the age of ten, since then his control had improved.

Examination showed a slight muscular weakness of all muscles below the right knee. Patellar reflexes were slightly exaggerated, but within normal; the tendo-achillis reflexes were both absent. Sensory disturbances for touch, pain, and temperature are shown in Figure 13. Control of the bladder seemed to be normal, although there was hypospadias, the meatus being closed; the anal sphincter was slightly relaxed, but competent. There was a chronic ulcer over the ball of the right foot. The fifth toe had been amputated. Palpation and the roentgen-ray revealed spina bifida occulta of the fifth lumbar vertebra.

An associated cerebral disturbance of the type commonly seen in cerebral palsy of childhood was present in two cases. In another case, which came to necropsy, the left cerebellar lobe was very small, measuring 2 by 2 cm.; the vermis was replaced by a dermoid. This recalls the cerebellar, medullary, and choroidal defects sometimes associated with spina bifida, in which a portion of one or all of these structures is apparently reduplicated or dislocated into the spinal canal, defects first described by Arnold and Chiari.

The prominence of speech disturbance, (Table 1) in

the symptomatology, usually of a dysarthric type, was unexpected. It should cause no surprise, however, since phonation is a recent acquisition, phylogenetically and ontogenetically, and hence is least resistant to neuropathologic processes (Brauer). It probably has the same significance that other associated developmental defects have. It is a curious fact that often the symptoms do not appear until in later life (Fig. 14). This is usually due to one of three causes: (1) the most common, traction on the spinal cord, resulting from adhesions between the lower end and the adjacent structures so that the relatively slower growth of the cord than of the vertebral column is interfered with, in which cases the sacral roots may actually run upward instead of downward; (2) superimposed degenerations of the spinal cord, probably based on the biologic inferiority, and (3) superimposed tumors. Superimposed degenerations that cannot be explained on the basis of growth form a very interesting complication and are often extremely difficult to interpret. The following case is illustrative:

*Case A108376.* Mr. J. S., aged 44, came to the Clinic June 18, 1914, complaining chiefly of paralysis of the legs and incontinence. Except for a lumbosacral spina bifida cystica, which had not given him any trouble, he had been in the best of health until eighteen years before, when he had developed a pain in the left groin and began dragging the left foot. This gradually became worse, and by the end of one year both legs were somewhat weak and numb. Crutches had become necessary ten years before examination; four years before incontinence appeared.

Examination showed, in addition to the spina bifida a trophic ulcer of the right buttock; complete paralysis of all muscles of the legs, with the exception of slight movement brought about through the quadriceps, gluteals, and adductors; and complete loss of sensation for touch, pain, and temperature below the level corresponding to the tenth dorsal segment, with a transition zone of about 6 inches above. Laminectomy was undertaken, and revealed a greatly degenerated cord with surrounding edema.

Five other patients gave histories of a similar nature. The youngest patient was 24, the oldest 55. In all of these, the question of superimposed tumor was raised. The course of the disease was progressive loss of function accompanied by some pain in four instances. The histories of these patients, briefly abstracted, are as follows:

*Case A167605.* Mr. R. J. T., aged 24, came to the Clinic July 27, 1916, complaining of impotence. He had been married three months. A sacral dimple with slight bulging above had been noted since birth. The present trouble had begun three years before, with a very slowly progressive loss of power in the legs.

The patient was unable to stand on his heels alone at the time of examination. Fibrillary tremors in the right thigh, slight diminution of all forms of sensation over the outer surfaces of the feet, more

pronounced over the right buttock, and progressive loss of control of the bowel and the bladder were noted. The right tendo-achillis reflex was absent. The x-ray of the spine was negative.

*Case 323248.* Mrs. R. McC., aged 35, came to the Clinic July 7, 1920, complaining of incontinence which had begun twenty years before, and aching in the legs thirteen years before. Paralysis of the left leg occurred thirteen years before, and of the right, three months before.

Examination revealed a sacral dimple, a palpable deformity, and webbed toes. The x-ray was negative. Almost complete paralysis of both legs below the knees and partial paralysis of the left hamstrings and quadriceps were noted. The left patellar and right tendo-achillis reflexes were absent. Rossolimo and Mendel-Bechterew reflexes were positive bilaterally, and there was complete anesthesia below the area supplied by the fifth lumbar segment.

*Case A264359.* Mr. C. L. N., aged 30, had had difficulty in starting urine since childhood and became incontinent at 21. He had had pain in the left lower extremity for nine years. Astragalectomy performed five years before gave no relief. Since infancy pressure on a lump over the lumbar area caused pain to radiate down both legs. His right foot had been clubbed ever since he could remember. The left leg had been somewhat weak for the past four months.

Both patellar and the right tendo-achillis reflexes were absent; the left tendo-achillis reflex was increased and Babinski was present. Sensory disturbances are shown in Figure 15. He had some incontinence of the bowel and of the bladder. Roentgenograms showed congenital defects of the second, third, and fifth lumbar vertebrae.

That tumors occur as a further complication of spina bifida is a well established fact. The tumors may be any of those ordinarily found, although fibrolipomas and gliomas seem to predominate; their removal has been accomplished occasionally (Elsberg).

A most interesting type of case is that with an analogous developmental spinal cord defect, or myelodysplasia without bony changes that can be demonstrated either by palpation or by x-ray; this type differs from the type described by Fuchs. It seems paradoxical to speak of this condition as spina bifida, since there is no spina bifida, and yet they clearly belong in this group. Three of the 187 cases were of this type:

*Case A259846.* Mr. J. E. W., aged 20, came to the Clinic February 18, 1919, complaining of incontinence and pain in the right lumbar region. The patient was born with a sinus over the sacrum, which had discharged until four years before. His sister had a similar sinus. He had been unable to control urine well since childhood and had enuresis regularly. Control of the bowel was normal. He had suffered greatly from severe nose-bleeds that were hard to control; there was no family history of hemophilia. He was unable to walk until eight years of age, but since then fairly well.

The patient's head was a trifle hydrocephalic. Over the sacrum was a pigmented depression covered by a few hairs. The urine contained a moderate amount of albumin and pus. Cystoscopic examination revealed a cord bladder, cystitis, pyelonephritis and ureteritis. An x-ray of the spine was negative; no palpable deformity was noted. The patient died of uremia March 15, 1919. Necropsy revealed no abnormality other than those noted on examination, and an incision made over the lumbar and sacral spine showed no bony abnormality; unfortunately the cord was not examined.

*Case 320499.* L. R., a boy aged 3, was brought to the Clinic June 18, 1920, because of paralysis of the legs. The child had been delivered by forceps and had been cyanotic; he cried a good deal the first year. He was bottle fed, sat up alone at one year, and began to speak at two years.

The child was alert mentally and used his hands well. The left leg was completely paralyzed; the right leg was very weak. The left patellar and tendo-achillis reflexes were absent; the right were normal. *Pes valgus* was bilateral. The child seemed to feel tactile and painful stimuli over the legs. He had no control of the bladder and bowel. X-ray examination and palpation of the spine were negative.

*Case A307648.* Mr. J. W., aged 43, came to the Clinic March 1, 1920. He complained of being fatigued rapidly and of spasms in the left calf following severe exertion, which had been noticed off and on for the past five years. The patient used an excessive amount of tobacco; otherwise his habits were good. He denied venereal infection. He had no history of previous illnesses or of enuresis. About two years before examination he had first noticed that the right calf was becoming gradually smaller than the left, but for the last six months there had been no change; he could give no explanation for this atrophy.

General examination and complete neurologic examination were negative with the following exceptions: slightly enlarged tonsils with an occasional plug; moderate hypertrophic rhinitis; periapical infection of one tooth; marked bilateral *pes cavus*, more so on the right than on the left, which had been present as long as the patient could remember, and hypospadias. The Wassermann test of the blood was negative. The spinal fluid test gave a negative Wassermann, a negative Nonne, and contained 2 small lymphocytes to the cubic millimeter. The patient suffered from pruritus of the anus and of the scrotum. There was marked loss of power and atrophy of the right calf, which measured 2 inches less in circumference than the left. The *tibialis anticus*, peroneals, and muscles extending and flexing the toes on the right side were moderately impaired in power. No fibrillary tremors were noted. The right tendo-achillis reflex was absent. Sensation for touch, pain, and temperature was normal throughout, including the perianal area. Vibration, joint, and tendon sensi-

bilities were normal. The vesical and anal sphincters were competent. X-ray examination and palpation of the spine were negative. These findings suggested a progressive cell degeneration of the anterior horn cells superimposed on a myelodysplasia.

The cases of myelodysplasia associated with spina bifida are of importance, not only from the diagnostic standpoint, but also from the standpoint of etiology. Cases of this type cannot well be brought in harmony with the view advanced by von Recklinghausen, that spina bifida is primarily the result of a failure of the mesodermal elements to develop properly, since in these cases the deficiency is evidently ectodermal and cannot be explained by any demonstrable mesodermal defect.

#### PROGNOSIS AND TREATMENT

The prognosis and treatment depend in a large measure on the type of the defect. According to the London Committee which undertook a study of spina bifida, 612 (95 per cent) of 649 patients with spina bifida cystica died in the first year of life (von Lewandowsky). Wernitz states that of ninety children not operated on, only twenty (22) per cent lived to be more than 5. Boettcher (1907) found that operation during the first two weeks of life was almost uniformly fatal. Fifty-two per cent of twenty-four patients on whom he operated died as a direct result of operation; the operative death rate in the most favorable type of case, the meningocele, was 25 per cent. None of the eight patients with myelomeningocele was operated on and all died. Many writers agree with Boettcher in not operating on patients with this type of case. A definite contraindication to operation is an increasing hydrocephalus; when this has come to a standstill and the spinal tumor shows little or no evidence of growth, operation may occasionally be ventured, although even then the mortality is high, 50 per cent. Operations undertaken on the brain in order to relieve the accompanying or resulting hydrocephalus are usually disastrous (Paterson). Ordinarily, patients with a marked paralysis in the lower extremities should not be operated on. Incontinence is usually given as a contraindication, although I have observed marked improvement following surgical interference despite the incontinence. The optimum age for operation on patients with the cystic type of spina bifida is from nine months to two years. The operative mortality in fifty-seven patients, including those with less favorable conditions than meningocele, was 21 per cent (Fig. 16).

The type of operation for spina bifida seems to make little difference. Saving time is a desideratum. There is no necessity of overcoming great pressure and no need of great protection, so that complicated procedures, such as transplanting bone, should be discouraged. Simple closure by a running suture, from the bottom outward is advised after the cord and nerve elements have been freed and dropped back into the canal; this operation has the



advantage of simplicity, speed, and effectiveness of closure. (Beckman and Adson).

Most writers are of the opinion that operation should not be performed routinely for spina bifida occulta; Boettcher, however, believes that exploration should be performed so as to avoid the possibility of later trouble. He represents the extreme view. It seems much better, after instructing the patient, to wait until the onset of secondary changes and then operate before much damage has been done, as Katzenstein advocates. Bibergell attempted to differentiate the type of cases in which the onset or aggravation of symptoms is delayed; he warned against operation in those cases in which there was a slow development of *pes cavus* and claw toes, since the inherent nature of these degenerations is such that surgery can result in no benefit, and he advised operation in cases in which the symptoms are the result of pressure on the nerve elements, as from tumors and fibrous bands. He does not suggest how these cases can be recognized with any degree of certainty, which in practice is certainly difficult. It seems advisable to give most patients in whom the onset of symptoms is delayed and the disability progressive, the benefit of exploration, since laminectomy in competent hands is now a comparatively safe procedure. Doubtless in a considerable percentage of cases exploration will reveal an irremediable condition, but the number is relatively small, and enough patients will be benefited to make routine exploration well worth while.

## BIBLIOGRAPHY

1. Arnold: Quoted by Schwalbe, E. and Gredig, M.: *Über Entwicklungsstörungen des Kleinhirns, Hirnstamms und Halsmarks bei Spina bifida. (Arnoldsche und Chiari'sche Missbildung)*. Beitr. z. path. Anat. u. z. allg. Path., 1907, xl, 132-194.
2. Baldwin, W. M.: The action of ultra-violet rays upon the frog's eggs. 1. The artificial production of spina bifida. Anat. Rec., 1915, ix, 365-381.
3. Bardeen, C. R.: Variations in susceptibility of amphibian ova to the x-rays at different stages of development. Anat. Rec., 1909, iii, 163-165.
4. Beckman, E. H. and Adson, A. W.: Spina bifida—Its operative treatment. St. Paul Med. Jour., 1917, xix, 357-363.
5. Bibergell, E.: Die klinische Bedeutung der Spina bifida occulta. Berl. klin. Wchnschr., 1913, i, 1481-1484.
6. Boettcher, T.: Die Prognose der Operation der Spina bifida. Beitr. z. klin. Chir., 1907, lili, 519-565.
7. Brauer, B.: The significance of phylogenetic and ontogenetic studies for the neuropathologist. Jour. Nerv. and Ment. Dis., 1920, li, 113-136.
8. Budde, M.: Die Bedeutung des Canalis neurentericus für die formale Genese der Rhachischis anterior. Beitr. z. path. Anat. u. z. allg. Path., 1912, lii, 91-129.
9. Chaussier: Quoted by von Lewandowsky.
10. Chiari: Quoted by Schwalbe E. and Gredig, M.: *Über Entwicklungsstörungen des Kleinhirns, Hirnstamms und Halsmarks bei Spina bifida. (Arnoldsche und Chiari'sche Missbildung)*. Beitr. z. path. Anat. u. z. allg. Path., 1907, xl, 132-194.
11. Conklin, E. B.: Heredity and environment in the development of men. Princeton, Princeton University Press, 1916, 309-360.
12. Cramer, K.: Zur Anatomie der Spina bifida occulta. Ztschr. f. orthop. Chir., 1913, xxxii, 440-441.
13. Cruveilhier: Quoted by von Recklinghausen.
14. Elsberg, C.: Spina bifida occulta with trophic disturbances, followed by fibrolipoma of cauda equina; operation; recovery. Jour. Nerv. and Ment. Dis., 1911, xxxviii, 289-290.
15. Ewald, P.: Über die Spina bifida occulta. Fortscher. a. d. Geb. d. Röntgenstrahlen, 1911-1912, xviii, 276-280.
16. Fuchs, A.: Über Beziehungen der Enuresis nocturna zu Rudimentarformen der Spina bifida occulta (Myelodysplasie). Wein. med. Wchnschr., 1910, lx, 1569-1573.
17. Hertwig: Quoted by Keibel and Mall.
18. Joachimstahl: Quoted by Bohnstedt, G.: Beitrag zur Casuistik der Spina bifida occulta. Virchows Arch. f. path. Anat., 1895, cxl, 47-79.
19. von Karwowsky: Quoted by Ebstein, E.: Hy-pertrichosis und Spina bifida occulta. Deutsch. Ztschr. f. Nerven., 1912, xliii, 81-92.
20. Katzenstein, M.: Beitrag zur Pathologie und Therapie der Spina bifida occulta. Arch. f. klin. Chir., 1901, lxiv, 607-629.
21. Keibel, F. and Mall, F. Eds.: Manual of human embryology. Philadelphia, Lippincott, 1910, i, 231-240.
22. Kellicott, W. E.: The effects of low temperature upon the development of Fundulus. A contribution to the theory of teratogeny. Am. Jour. Anat., 1916, xx, 449-482.
23. Lewandowsky, M.: Spina bifida. Die Missbildungen des Rückenmarks. Handbuch der Neurologie. Berlin, Julius Springer, 1911, ii, Spez. Neurol., i, 446-455.
24. Lewis, W. H.: The experimental production of cyclopia in the fish embryo (Fundulus heteroclitus) Anat. Rec., 1909, iii, 175-181.
25. Lücke: Quoted by Bohnstedt, G.: Beitrag zur Casuistik der Spina bifida occulta. Virchows Arch. f. path. Anat., 1895, cxl, 47-79.
26. von Monakow, C.: Zur Entwickelung und pathologischen Anatomie der Rautenplexus. Schweiz. Arch. f. Neurol. u. Psych., 1919, v, 378-392.
27. Morgagni: Quoted by von Recklinghausen.
28. Morgan, T. H.: The effects produced by centrifuging eggs before and during development. Anat. Rec., 1909, iii, 155-161.
29. Paterson, R.: The treatment of spina bifida by drainage of the central subdural space. Lancet, 1908, ii, 456-457.
30. Peltsohn, S.: Beiträge zur Kenntniss der ange-

- borenen Fussverbildungen. *Berl. klin. Wehnschr.*, 1920, lvii, 111-113.
31. Peritz, G.: Enuresis nocturna und Spina bifida occulta. *München med. Wehnschr.*, 1911, lviii, 714-715.
  32. Ranke: Quoted by Katzenstein.
  33. von Recklinghausen, F.: Untersuchungen über die Spina bifida. *Virchows Arch. f. path. Anat.*, 1886, cv, 243-330; 373-455.
  34. Schlesinger, H.: Fall von Pseudohypertrophia muscularis, bei welchem ein komplizierendes Myxödem durch Thyreoidbehandlung rasch geheilt wurde. *Mitt. d. Gesellsch. f. inn. Med. u. Kinderh. in Wein.*, 1905, iv, 219.
  35. Schmaus, H. and Sacki, S.: Pathologische Anatomie des Rückenmarks. Wiesbaden, J. F. Bergmann, 1901, 490-496.
  36. Sharpe, N.: Spina bifida—an experimental and clinical study. *Ann. Surg.*, 1915, lxi, 151-165.
  37. Spieler, F.: Blasenmastdarmstörungen infolge einer mit Lipom kombinierten Spina bifida occulta sacralis. *Mitt. d. Gesellsch. f. inn. Med. u. Kinderh. in Wein.*, 1905, iv, 157-159.
  38. Stockard, C. R.: The artificial production of one-eyed monsters and other defects, which occur in nature, by the use of chemicals. *Anat. Rec.*, 1909, iii, 167-173.
  39. Tillmann: Quoted by Bibergeil.
  40. Tubby, A. H.: Deformities including diseases of the bones and joints. London, Macmillan, 1912, i, 234-236.
  41. Tulp: Quoted by Bernstein, W.: Ein Beitrag zur Kasuistik der Spina bifida. Berlin, Ebering, 28 pp.
  42. Virchow: Quoted by von Recklinghausen.
  43. Werber, E. I.: Is pathologic metabolism in the parental organism responsible for defective and monstrous development of the offspring? *Johns Hopkins Hosp. Bull.*, 1915, xxvi, 226-229.
  44. Werber, E. I.: Blastolysis as an morphogenic factor in the development of monsters. *Anat. Rec.*, 1915-1916, x, 258-261.
  45. Werber, E. I.: Experimental studies on the origin of monsters, *Jour. Exper. Zool.*, 1916, xxi, 485-574.
  46. Wernitz: Quoted by Ewald.  
187 patients having spina bifida. (Case 261454.)

#### DISCUSSION

DR. JAMES A. JOHNSON, Minneapolis: This is an extremely interesting subject. It is a subject upon which not a great deal of definite work has been done, except that which comes from clinical experience.

Let us consider for a moment the three theories that come prominently into play. The first is the germinal theory; in other words, embryologic defects. If it is due to these, it must develop very early. For instance, in the cases in which the cord is developmentally defective; in which there are no membranes at all, the condition must come on within the first three weeks of prenatal life. Such cases are

occasionally seen in obstetric practice and are usually born dead.

The other theory, that of increased pressure in the spinal cord, seems to me from a clinical standpoint to be the most tenable theory. In other words, it is either an increased secretion of fluid through the choroid plexus, or it is in some measure a lack of absorption. Which we do not know. It is probable that there is an increase in the secretion. There are experimental and clinical reasons for believing this. First Weed, of Johns Hopkins, has fairly well proven by injecting different solutions in the embryo that the spinal circulation begins at about the seventh or eighth week. Since we know the closure of the spinal canal takes place at this time, it is very easy to suppose that an increase in pressure of this fluid may have a great deal to do with forcing open or with the prevention of the union of the spinal canal. Second, spina bifida occurs most frequently in the sacral region and in the cervical region, and these are the two last places for the spinal canal to fuse. Third, a great majority of these cases have hydrocephalus prenatal, and that this condition increases at a tremendous rate in some instances after they are born, and particularly if you operate on them early.

The environmental theory is interesting; it leads us into the chemistry of metabolism of prenatal life of which practically nothing is known we doubt in time it will be worked out and add a new chapter to medical science.

The treatment is discouraging. In cases which are completely without a membrane, of course there is nothing to do. They are usually born dead. If they are born alive, they will die early after birth. The second class of cases, those that have a thin covering, in which you often have a myelomeningocele or fibers of the cord involved, are often born with other developmental defects, such as talipes, cleft palate, partial or extensive paralysis of extremities. They are not infrequently born with paralysis of the sphincter muscles of both the bowel and bladder. It is useless to do anything with them. Pressure on the meningocele is so great that it soon begins to ulcerate, becomes infected, and they die from a meningitis.

In another class of cases, the 3rd group, in which the meningocele is well covered with normal skin, in which there are no other deformities or paralyses, and little or no hydrocephalus, we may hope for some definite relief from surgical procedures. It is well to remember, however, that they should not be operated early, especially if there is a tendency to hydrocephalus. I have seen these cases repeatedly after early operation rapidly develop a tremendous hydrocephalus and in a very short time terminate fatally. Since there is nothing lost by waiting it has become a definite rule with me not to operate till after two years and in some cases even later, especially if the general health of the child is not good.

Many treatments have been devised, but all are

relatively unsatisfactory except excision of the sac. This in favorable cases, especially when the nerves are not involved, and there is little or no hydrocephalus, has given almost universally good results. After excising the sac the defect in the spinal canal should be covered by bringing the muscles and fascia together from either side.

DR. E. M. HAMMES, St. Paul: Dr. Waltman has illustrated his cases so well with lantern slides and has given us so much information, that very little can be added to what he has said.

I wish to say a few words regarding the surgical aspect. Cases of spina bifida with large tumor and with hydrocephalus, especially if increasing, are only interesting from the standpoint of diagnosis. Surgery offers no hope for these unfortunates as they usually die sooner or later. The only indication for surgery in these conditions is the danger of the sac rupturing with an impending meningitis.

There are two groups of cases in which surgery has been crowned with some results. One class is the simple meningocele, and the other the cases of spina bifida occulta where the symptoms develop late in life. In both of these groups the prognosis as to life following operation is favorable, and the outlook, as far as permanent recovery is concerned, is fair. According to Hildebrand, 39 per cent of these cases make a permanent and complete recovery. The best time to operate is between eight and nine months or two years of age. In these cases of spina bifida occulta, symptoms frequently do not develop until late in life. At operations sometimes one can find nothing but adhesions, the removal of which may be crowned with some benefit.

Leopold reported the case of a girl, 6 years of age, who was perfectly normal at birth. At the age of 6 she had a complete loss of bladder and rectal control. At operation, Leopold found some adhesions which he loosened, closed the wound, expecting no result. After four weeks the patient had complete control of the bladder and rectum, and it was learned subsequently that she had complete control of the bladder function for several years.

#### TUBERCULOUS PERITONITIS\*

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Tuberculous peritonitis is far more common than is usually believed because of the varied manifestations of the disease. The cases in which there is serous effusion may be diagnosed, but the dry forms are often overlooked, the major lesion, often pulmonary, overshadowing the abdominal condition. Evidences of this are the various necropsy reports from sanitariums for

the treatment of tuberculosis. Of 531 patients who died from pulmonary tuberculosis in the Brompton Hospital, London, 4.1 per cent were found to have tuberculous peritonitis; of 300 in St. George's Hospital fifty-six (18.6 per cent), of 197 in the Boston City Hospital, 7.1 per cent, and of 1393 in a sanitarium of Breslau 226 (16.2 per cent\*). One-half of the 306 children less than fifteen years of age with tuberculous peritonitis were between 3 and 6 (Faldi).

During the last few years there has been much discussion of the varied findings of bovine and human tuberculosis in children and in adults. The English Commission for Investigation of Tuberculosis found the bovine type of bacillus in fourteen of twenty-nine cases; the German Commission found the bovine type in 63 per cent of the cases of abdominal tuberculosis. In New York it was found in forty-four (62 per cent) of seventy-one cases; 25 per cent of the adults with tuberculosis and 69 per cent of the children had the bovine bacillus.\* The bovine form of the disease is largely preventable by elimination of tuberculous cows. During lactation the udder is essentially an eliminating structure, even though it is not involved locally, just as tuberculosis bacilli are passed from healthy kidneys when the focus is elsewhere in the body. If the udder is tuberculous, numerous bacilli may be found in the milk. Milk from untested dairy cows should be pasturized.

The surgical treatment of tuberculous peritonitis dates from the accidental finding of the disease by Sir Spencer Wells in 1862, who, in operating on a girl, aged 22, for suspected ovarian cysts, discovered the condition; the patient made a recovery, although nothing but the fluid was removed. The next report was that of König, in 1884, who treated four cases by laparotomy, removing the fluid, and closing without drainage, with three recoveries. In 1890, König reported 139 cases treated, with eighty-four recoveries; twenty-four for more than two years.

Tuberculous peritonitis is not a primary disease but secondary to a tuberculous process or other foci in a contiguous structure. Tuberculosis of the mesenteric glands may ulcerate through the peritoneal surface and deliver caseous material into the peritoneum, causing

\*Presented before the Southern Minnesota Medical Association, Mankato, November, 1920.

diffuse miliary deposits. In adults, tuberculosis may occur in the upper abdomen from tuberculous ulcer of the stomach, of the gallbladder, of the spleen, or of mesenteric glands; in children it usually originates in the mesenteric glands. In children tuberculosis is the most common cause of ascites, although in them peritonitis is often caused by streptococci in the same lymph areas. Hyperplastic tuberculosis of the intestine very rarely causes diffuse peritoneal tuberculosis, except when it occurs as tuberculosis of the appendix which is found in males and females at practically all ages. A stricture at the cecal juncture maintains a pure culture of the bacillus, and ascites occurs. In approximately half of the cases the lesion is confined to the appendix; in the remainder the lower end of the cecum or even the ileocecal valve is involved. The most frequent cause of tuberculous peritonitis is tuberculosis of the fallopian tubes with leakage into the peritoneum; many miliary deposits are found throughout the abdomen; the parietal and visceral peritoneum is studded with them. In the male the complementary structure, the epididymis, is often affected by tuberculosis, but the peritoneum is not involved. Because of this the number of males who develop tuberculous peritonitis from a genital cause is materially smaller than the number of females. The diagnosis is always easy, as in tuberculous conditions there are a great variety of reactions. In acute cases the temperature may be high, while in the cases of more chronic insidious development there is practically no increase in temperature. Albumin appears in the urine in about 50 per cent of the cases and bladder irritability is frequent. A real difficulty in diagnosis is differentiating the ascites caused by rupture of the small carcinomatous ovarian cyst. The small implants of carcinoma on the peritoneum in certain cases greatly resemble miliary deposits.

Only the cases of tuberculous peritonitis with general or local ascites or the cases of the plastic type with pelvic masses are considered surgical. Since most such conditions occur in patients between 20 and 40, the rather rapid onset and distention with great thickening of the peritoneum led to operation in women for presumed ovarian cyst in nearly one-third of the earlier cases recorded by Osler. Operations

for the removal of ascitic fluid, supposedly due to hepatic cirrhosis, has often disclosed a tuberculous condition in patients between 40 and 60, while a large proportion of unsacculated cystic tumors of the abdomen are the result of adhesions surrounding a tuberculous process, usually ulceration over a mesenteric gland, or surrounding the hyperplastic variety of intestinal tuberculosis which is chronic and often accompanied by severe colics and obstruction.

It is estimated that tuberculous peritonitis is relieved by medical treatment, according to Ochsner in 50 per cent of cases, Allbutt and Rolleston believe that spontaneous cure occurs in about 50 per cent. Indications for surgery are not questioned if the cause is due to obstruction from the hyperplastic type of lesion and relief can be secured by excising the diseased segment of intestine, or, if the tumors are found to be too numerous and scattered, by short-circuiting the diseased areas of the intestine to relieve the obstruction. This obstruction, however, occurs but rarely in tuberculous peritonitis with ascites, as in only a few instances does the ulceration cause miliary peritoneal deposits and ascites; the disease represents a special type. There is no question that patients with tuberculous peritonitis have a tendency to recover; surgeons often discover calcified glands in the mesentery, evidence of an old tuberculous lesion, possibly of the bovine type in children, and gross evidence of plastic adhesions, the result of the plastic form of the disease which had occurred years before in young adults with few symptoms.

Admitting that many recoveries follow medical or no treatment, or incomplete surgical treatment such as removal of fluid alone, and it is usually conceded that there are other foci of infection, the question is, Do these patients remain well? So far investigation has shown that a considerable percentage of the patients have died within a few years from tuberculosis. In the early stages of the disease the patients may have ascites following a short period of abdominal colic. The pain can be likened to that with pleurisy, since it is relieved by the development of fluid. In the acute and sub-acute condition a temperature of from 103° to 104° is noted. The pulse varies from 80 to 120. In the more chronic cases the skin is fre-



quently dusky, almost pigmented, especially in emaciated persons, and usually there is loss of weight. The peritoneum is greatly thickened and gives an appearance of increased roundness to the abdomen. A diagnostic feature which I have found practically always is a feeling to the fingers of lobulation of the fat in the abdominal wall, as if small lobules, the size of peas, covered the abdominal muscles. While not indicative of tuberculosis alone, the lobules do indicate chronic inflammation and thickening of the peritoneum.

The early treatment of this condition was considered wholly medical for a time and later, following the first case of Spencer Wells, wholly surgical. The operation consisted in a laparotomy incision, removal of fluid, and closure without drainage; if the surgeon examined the peritoneum he reported all parts nearly equally involved and no reason for removing any area. Some operators irrigated the abdomen with salines, others poured in iodoform and glycerine emulsion, others opened the abdomen freely and exposed its contents to the sun for a few minutes, and warm air was blown over the intestines. American surgeons made the closure without drainage, English surgeons established drainage rather frequently; this practice, however, seemed to increase the risk, through the danger of mixed infection. The *bacillus tuberculosis* was nearly always in pure culture and the presence of mixed infection added greatly to its destructive and chronic character. Some physicians believed that nothing should be done except to remove the fluid, and they considered a trochar a suitable instrument for this. If air was of value, it could be injected into the cavity before the trochar was removed. McGlinn injected oxygen after the removal of the fluid by paracentesis. Such procedures had but little following.

Careful study shows that there is a real principle involved in the origin of the condition; first, it is practically always a pure tuberculosis, the bacilli being carried in the blood stream; second, except in the type caused by the breaking down of a mesenteric gland, a mucous membrane lesion is connected with the peritoneum; and third, the irritation from the miliary deposits is often the cause of an exudate, at first serous, next fibrinous, and finally plastic.

The tuberculous lesion or lupus in the mucosa is a chronic condition. One of the most practical papers which has been written on the subject is that by the late John B. Murphy who called attention to the involvement of the fallopian tubes in tuberculosis with the open fimbriated ends leaking the tuberculosis contents into the abdomen, and to the fact that practically all other infections close the end of the tube. When the abdomen is opened and the fluid removed, the source of the lesion can often be determined by the confluent appearance of the miliary deposits near the focus and the discrete appearance at a distance from the exuding area. In a few cases, before we realized the importance of the mucous membrane lesion we made a laparotomy in the same patient two or three times for removal of the ascites, and sponged out the fluid with gauze pads. We observed that the serous ascites was changed by operation into a fibrinous ascites and then into a plastic, that the enlarged tubes, if they were the cause in the plastic type of disease, were encapsulated into the culdesac by adhesions of intestine and omentum, that the miliary deposits disappeared as soon as the exudate was confined, and that a caseous mass formed in the tube which was ultimately cared for like a large tuberculous gland. But within five years a number of the patients died of general miliary tuberculosis or pulmonary tuberculosis which was not manifest, or at least not active, at the time of examination. We then began treating the local condition as a focus. If it could be determined that the focus was in the fallopian tubes, the tubes were removed into their insertion in the cornua of the uterus since of a portion was left, secondary small abscesses formed in the muscular tissues of the uterus. I wish to deprecate, however, the removal of the fallopian tubes because of miliary deposits on their peritoneal surface; unless they are enlarged, nodular, and with gross evidence of disease, there is another abdominal focus and the patient will not be benefited by their removal. It is very rarely necessary to remove an ovary, even in extensive involvement of the tubes. The uterus is only involved on its surface during menstrual life. Small ulcerations may occur from surface invasion; involvement of the interior of the uterus may occur before puberty

and the caseous content, discovered years afterward, apparently does not cause tuberculous peritonitis. Patients in this condition do not menstruate. If they have a high temperature, 103° or 104°, medical treatment should be instituted until the morning temperature is reduced to 100° before surgery is advisable as these patients must develop their own tuberculin, so to speak, before repair is active, and early operation may be followed by acute miliary tuberculosis.

Some patients have passed through the ascitic stage and reached the fibrinous and plastic stages of adhesion development when they are first seen by the surgeon. In females a vaginal or rectal examination often discloses a fixed pelvic mass. These patients, although on the road at least to temporary recovery are liable to the development of active tuberculosis in some other region at a later period; we therefore advise abdominal operation to remove the primary abdominal focus if possible, as we may thus remove the overburden which may determine the final result. The uterus, tubes, and ovaries are found buried beneath a mat of intestinal adhesions. The diseased area is approached, not by tearing the intestinal adhesions apart, because although they may appear to be serious, there is no obstruction, but by following the round ligament to the horn of the uterus, a sufficient opening can be made to enucleate the tubes; they are stiff, fibrous, with caseating content, and readily peel out. It is unnecessary to separate any adhesions except the local area over the tubes. Should an intestine accidentally be torn it must be sutured and held by sutures against some adjacent peritoneal surface for additional protection, or folded on itself, since the abdominal incision should be closed without drainage. Often the contents of the tubes resemble purulent material, but because the lesion is purely tuberculous and these patients have a fair degree of immunity, the wound may be closed with impunity. For this reason total hysterectomy is not indicated either in the ascitic or plastic condition as it may lead to infection and fistulas or a discharging sinus. In closing the abdominal wound the thickened peritoneum and the transversalis are closed by a running suture. The wound is sponged with a tincture of iodine and a layer closure made,

supported by a firm bandage. This method reduces to a small percentage the secondary tuberculous infections of the divided fascia and muscle. Should a fistula occur it is best treated by an occasional injection of Beck's bismuth and iodoform paste. Since patients with tuberculous peritonitis and active pulmonary lesions are usually not subjected to operation, anesthesia may be secured by light ether administration.

If the cecum is not involved in cases of tuberculous appendix an appendectomy will result in cure. If the cecum is involved removal of the appendix frequently leads to a chronic fistula. In a dry peritoneum with tuberculosis in this region resection of the cecum is advisable. Apparently, however, in the hyperplastic type of tuberculosis of the intestine there is as a rule little or no excess of peritoneal fluid, which reduces the dangers of resection. Chronic serous peritonitis is rarely found; it occurs with a greatly thickened fibrosis of the peritoneum, all the mesenteries are shortened, and the thick layer of organized exudate which cannot be removed is sometimes yellow or pearly white. Such chronic ascites is sometimes discovered in the upper abdomen during exploratory laparotomies. The preoperative diagnosis is often hepatic cirrhosis with contraction of the liver, in which the proposed operation is drainage of the peritoneal cavity into the preperitoneal tissues by the use of the omentum (Talma-Morison) but no omentum can be found on exploration since it is completely contracted and covered in by the exudate. Pick first described the condition associated with obliteration of the pericardium by adhesions to the heart, which he considered primary, and the abdominal condition secondary. In one case of Pick's disease I could not find any local focus; the patient died following operation. Concato believes the condition to be abdominal. Some type of chronic infection is undoubtedly the essential etiologic factor. Although tuberculosis cannot be said to be a common cause, I have seen one case of Concato's disease in which there were large tuberculous tubes with fimbriated ends open and filled with caseous and granulomatous material, but without miliary tubercles which would not be expected from the extent of the organized plastic deposit.

In tuberculous peritonitis the prognosis depends on amount, location, activity of the disease, and associated diseases; age is also an important factor. Taylor believes in a fatal prognosis in more than half of the cases of tuberculous peritonitis. This certainly includes advanced gross tuberculosis with the tuberculous peritonitis the minor lesion. Death in many instances should be attributed to tuberculous conditions other than the peritonitis.

From January 1, 1908, to June 1, 1920, 195 patients with tuberculous peritonitis have been operated on in the Clinic, 153 females and forty-two males. One hundred fifty-seven women had tuberculous peritonitis in this period, many the dry or encapsulated form; 8.7 per cent of the latter had pulmonary tuberculosis also. The operative mortality was 1.5 per cent. During the last ten years we have treated medically about 260 patients without surgical indications whose diagnosis was abdominal tuberculosis. Tuberculin is of value in raising the resistance, but should be used in larger doses than generally believed indicated.

#### CONCLUSIONS

We consider cases of tuberculous peritonitis very favorable for cure in most instances, at least if the abdominal condition is the main factor. The possibility of cure of such forms of tuberculosis is due to its being confined where it can be attacked by nature's forces, as a gland is destroyed by disease and undergoes caseation and calcification in the curative process. In areas that can be spared without destruction to life, surgical elimination is of great benefit. Thus nature can cure tuberculous peritonitis in pure form. Mixed infection destroys tissue, but added toxins are destructive to life as well as to tissue and are more chronic and difficult to treat or control. If ascites in tuberculous peritonitis adds so enormously to the surface area involved in a tuberculous process and must be overcome by changes in the peritoneum by changing the exudate from serous to fibrinous and plastic adhesions before cure occurs, such surgical treatment as will hasten the process is advisable. The important question is with regard to the permanency of cure and restoration to health. Death or even ill health rarely comes from obstruction due to the adhesions. When acute obstruction develops it is due to a

single band or the hyperplastic variety without ascites. By removing the focus of disease in tuberculous peritonitis, especially when such a focus involves a tuberculous mucous membrane, a high percentage of permanency of cure with a very low primary operative mortality is secured.

#### BIBLIOGRAPHY

1. Allbutt, C. and Rolleston, H. D.: A system of medicine. London, Macmillan and Co., 1908, iii, 957-978.
2. Concato, L.: Sulla poliiorromennite scrofolosa o tisi delle sierose. *Glor. internaz. d. sc. med.*, 1881, n. s., iii, 1037-1053.
3. Faludi: Quoted Osler and McCrae, p. 721.
4. König: Ueber diffuse peritoneale Tuberkuulose und die durch solche hervorgerufenen Scheingeschwülste um Bauch, nebst Bemerkungen zur Prognose und Behandlung dieser Krankheit. *Centralbl. f. Chir.*, 1884, xi, 81-85.
5. König: Die peritoneale Tuberkulose und ihre Heilung durch den Bauchschnitt. *Centralbl. f. Chir.*, 1890, xvii, 657-660.
6. Murphy, J. B.: Tuberculosis of the female genitalia and peritoneum. Chicago, 1903, 119 pp.
7. Ochsner, A. J. and Percy, N. M.: A new manual of surgery. 5 ed. Chicago, Cleveland Press, 1917, 286-290.
8. Osler, W. and McCrae, T.: Modern medicine. Philadelphia, Lea and Febiger, 1914, iii, 720-730.
9. Taylor, F.: Quoted by Osler and McCrae, p. 723.
10. Wells, T. S.: Quoted by Osler and McCrae, p. 729.

#### DISCUSSION

DR. EMIL G. BECK, Chicago, Illinois: The paper of Dr. Mayo teaches the great lesson of immunity. Why do patients upon whom we operate get well and stay so permanently, where the focus of disease has been eliminated, and why is it that other patients that have been simply explored do not always get well?

We have three kinds of immunity: First, Natural immunity with which we are endowed when we are born, a certain degree of immunity against all disease. If that were not true, we should die from the effects of the first breath we take, for it is laden with germs. Second, We acquire immunity to those diseases to which we are exposed or with which we are attacked. Third, We may produce artificial immunity. We immunize patients by vaccines, by medical treatment, by hygienic measures, and so on. But we may also immunize by surgery, as proven by the paper of Dr. Mayo.

I wish to give an illustration of how disease and immunity try to balance one another during the life of a patient. Let us illustrate this by a fictitious case: if for instance, a patient is afflicted with marked tuberculosis of his right kidney, and his left is also slightly affected, and the bladder also.

At the same time he had scattered foci of the tuberculosis in the lung, and in other parts of the body. During the development of this extensive distribution of the disease the formation of immune substances have tried to keep pace with the progress of the disease, but has not succeeded in developing at a faster rate than the disease, so that the quantity of immune substances is too small of overbalancing the extent of the disease.

For further illustration, let us represent the amounts of immunity and the disease by units and take an inventory of the present status. We represent this in a form of "Debit" and "Credit" account, placing the unit of disease on the "Debit" side, and the amount of immunity on the "Credit" side. Then the table shows that the total of the units of disease are 49, and of immunity 39. Thus the patient is lacking at least ten units of immunizing substances to balance up with the units of disease. But he should have more; he should have a surplus of immunity in order to eliminate the disease. How can this be accomplished in this case?

Although we are unable to increase the immune substances, we are able, to reduce the disease. In this instance, we remove the right kidney, which represents 20 units of disease. By doing this, we change the status of his account. We will have then only 29 units of disease, and 39 units of immune substances, and thus a surplus of ten units in favor of the immunity. The body is brought into a state of SUPER IMMUNITY. A state very favorable for recuperation. The immune substances which are required to keep in check the progress of the diseased kidney, are through its removal released, and, take care of the remaining foci of disease; and thus the diseased foci in other parts of the body will heal spontaneously. The figures are not based on any definite measurements, of immunity and disease, for such measurements do not exist. These figures are merely improvised to facilitate the illustration of a principle. They will not seem theoretical when compared with what actually happens. We find that when we remove a tuberculous kidney, in a patient who has a tuberculous bladder at the same time, the removal of the kidney will, in many instances, produce the spontaneous healing of the bladder which here-to-fore resisted the most painstaking treatment.

Therefore, we see, that in the removal of the tubes there is a great advantage to be gained, provided they are really diseased. They are the foci of the disease, and if we remove them, the patient will likely to be permanently benefited.

DR. CHARLES H. MAYO (closing the discussion):

Dr. Beck brought up the interesting subject of the development of immunity. There is no question that a great majority of us are exposed to tuberculosis and resist it. Every surgeon of experience occasionally in opening the abdomen finds evidences that years before a tuberculous condition involved the glands. On palpation the glands in the mesentery are found to be quite hard, rough, irregular masses of lime, although some may break through early into the peritoneum and be disseminated. In many cases the focus of origin of the tuberculosis cannot be located. The question comes up of the duty of physicians toward the communities in which they live. One of the main things to contend with in the smaller cities and towns is the inspection of cows and meat. In Minnesota only a half dozen cities have any inspection of herds of cattle that are supplying them with milk. I worked two years before I succeeded in getting an ordinance approved to have cows tested for tuberculosis in Rochester, and finally when it was forced through the mayor vetoed it. I then had to call on the women for assistance. If you are trying to clean up a city, or abolish anything that is a cause of the impairment of health of children, never ask the fathers to attend a meeting. They are too busily engaged in business, and they dislike to do anything that might antagonize somebody who trades with them. They would rather sacrifice the children. Only a few men who have any influence will attend the meetings, and they will attend it as they would a moving picture show. You should aim to get the mothers to attend the meetings. Get them interested by explaining graphically, as Dr. Beck did, the destructiveness to children of bad milk and the enormous number of children affected by tuberculosis. People in small cities should have the same right as people have in large cities. They should have good meat, and proper inspection of milk, which is of the greatest importance.

One-half of all the children with tuberculosis who come to our Clinic come from a section of country running west fifty miles. This district is probably badly infested with tuberculous cows. A government inspector of dairies told me that from 12 to 26 per cent of these cows showed tuberculosis on the block. In marked cases of tuberculous peritonitis the abdominal fat feels like a mass of peas in a layer of cotton. The same occurs in carcinoma. It leaves the peritoneum four times its normal thickness, with an increased blood supply, and there are lobulations of fat of this type found in animals of hibernation. They absorb all intermediate fat. It is of special aid in the diagnosis of chronic peritonitis.





# MINNESOTA MEDICINE

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## EDITORIAL

### MINNEAPOLIS CLINIC WEEK

When one stops to consider the vast number of opportunities which present themselves to the medical profession for the dissemination of medical knowledge — medical journals, post-graduate courses, fellowships, conventions, clinics, and the like, it is small wonder that our profession maintains a high standard of achievement. Opportunities present upon all sides, and physicians who do not avail themselves of the same are withholding from their clientele much that is due.

It is important to keep abreast of the times by covering the literature and by attending conventions, but it is a well recognized fact that only by observing the methods of others in the application of their knowledge can one appropriate to one's own uses the most important, scientific facts and methods of procedure so essential to success. Of all methods of acquiring information, observation is by far the best, and the most effective manner of teaching is by demonstration. Thus while our conventions and journals have a place and are highly desirable, they cannot in the very nature of things furnish the doctor the practical post-graduate course that the clinic so satisfactorily does.

The difference is that in one instance the

physician is told, and in the other is shown how things are done. To our profession great credit is due because of the willingness on the part of its members cheerfully to give up to others the information or knowledge which is possessed. If adverse criticism is to be offered, it should relate more especially to the members of our profession who refuse to accept the knowledge offered by clinicians when the opportunity presents. Thus, notwithstanding the fact that it is a universal observation that the physicians who do travel and give up their time in order to obtain such education not only become better physicians, but find themselves well repaid financially for the outlay of time and money.

Minneapolis Clinic Week was conceived with this end in view. It was the first effort of its kind that had been developed in this territory, and it has proved a success from the first. It has not only developed clinicians and taught them to do more careful and scientific work, but has been a stimulus to visiting physicians from all over the Northwest who have attended any of these meetings.

The physicians of the Northwest are to be congratulated on the opportunity presented during the week of April 25th when the Fourth Annual Clinic Week will be held in Minneapolis. A tentative program shows that the committee in charge has outdone even its former efforts and has arranged a program that no one can afford to miss. The date is very happily chosen, coming as it does just after the winter's work and at a time when many will be able to avail themselves of an automobile trip to the city.

Minnesota Medicine joins with the physicians of the Northwest in congratulating the Clinical section of the Hennepin County Medical Society upon this and its past efforts.

### THE REMARKABLE CASE OF MIRIAM RUBIN

How a man morally or intellectually honest can be a chiropractor is beyond comprehension. It is conceivable that a chiropractor may be morally honest but lacking in his inductive and deductive reasoning, but that this is true of the majority is questionable. It seems more likely that the majority are intel-

lectually keen but should be classed with the charlatans.

We are the more confirmed in our opinion by the recent nation-wide advertising being conducted by these individuals. We refer in particular to the advertisement of the miraculous cure of little eight year old Miriam Rubin, of Waukegan, Illinois. Silence is generally admitted to give consent, and in this case silence would give credit to spinal manipulation for the accomplishment of results unobtainable by medical science. If the statements appearing in the advertisement were true, well and good. From start to finish they are false.

The advertisement states that the little patient was afflicted with a strange talking malady, and talked incessantly for two hundred and twelve consecutive hours until a certain meek chiropractor found the second and fifth vertebrae in the child's spinal column out of position and adjusted them. The child is reported to have recovered.

The facts, as disclosed by the American Medical Association, are:

1. The child suffered not from a strange "talking" sickness, but from a form of encephalitis with excitation.

2. The "incessant" talking was in reality intermittent, both before and after the alleged "adjustment".

3. The chiropractic "treatments" did not "cure" the disease as claimed; they had no appreciable effect on its course.

4. The nurse's record shows that the chiropractor gave "treatments" from February 12th to February 23rd, at which time he was dismissed as the patient's condition gave no evidence of benefit from his "treatments". On the contrary, she was complaining of severe pains along the course of her spine. Since then the family physician has had entire charge of the case.

5. The patient is not restored to health; on March 1st she was seriously ill."

### THE EYE SIGHT CONSERVATION COUNCIL

The medical profession in general heartily endorses any organization whose aim is the betterment of mankind in general. The recently organized "Eye Sight Conservation Coun-

cil" is such an organization. It is a membership organization and plans a nation-wide "save your sight" publicity campaign. While similar campaigning is often overdone, there is no question but that in the matter of neglect, the eyes and teeth are close contestants for the prize.

Of course an aroused interest in the betterment of vision will increase business for opticians, optometrists and oculists temporarily at least. The optical industry is admittedly backing the movement for they will be ultimately benefited. Professional men representing various organizations devoted to health welfare, education and science, are also behind the undertaking. Like so many of these humanitarian movements the activities of this Council will result in less disease and therefore less need for the services of the physician in general.

The personnel of the council appearing elsewhere in this issue indicates the character of the organization. Its work should be of special interest to ophthalmologists.

## NEWS OF THE HOSPITALS

Dr. George Earl, Vice President of the Mounds Park Hospital, has been absent for some weeks in Philadelphia.

Dr. Geo. H. Freeman, superintendent of the State Hospital at Willmar, made a recent professional business trip to St. Cloud.

Dr. John F. Smith is now House Physician of St. Barnabas Hospital, having succeeded Dr. Bernard Soroze who has taken up a private practice at Barnesville, Minnesota.

The Alumni of Johns Hopkins Hospital held a banquet at the Minneapolis Club and Dr. Cook, of Minneapolis, was elected president of the Northwestern branch.

Dr. P. L. Halenbeck, of Crosby, who for the past six months has been associated with Dr. F. A. Allen, has purchased a half-interest in the Cuyuna Range Hospital at that point.

The Board of Directors of the Miller Hospital met on March 9th when a discussion of finances was held. The hospital is gradually filling up, having enjoyed a very creditable month during February.

A supply of radium has been received at St. Luke's Hospital and X-Ray treatments are now being administered on a more extensive scale. Miss Gilman, of the Beebe Laboratories, has been appointed Laboratory and Pathological Technician. Adah H. Patterson, Superintendent, is identifying herself with

the million dollar drive in behalf of a Nurses' Training School at Johns Hopkins University.

Dr. List of the General Hospital of Minneapolis has withdrawn his resignation, and is again serving in the capacity of superintendent. Dr. Goedel has been placed in charge of the Department of Anesthesia.

As a result of the annual meeting recently held at St. Joseph's Hospital the following officers were elected: Dr. Wm. Davis, President; Dr. Arnold Schwyzer, Vice President, and Dr. Wm. Carroll, Secretary. Cases were discussed after the meeting.

Overtures have come recently to the University of Minnesota from a number of hospitals, looking to a merger of their training schools for nurses with The School of Nursing of the University. Already such an arrangement has been made with the new Charles T. Miller Hospital of St. Paul and negotiations are pending with other institutions.

The primary purpose of this merger is to standardize the education of nurses in the State of Minnesota, while by a system of rotation services in the several hospitals the student will be given a better rounded course of training. The preliminary courses of instruction are to be unified at the University and thereafter a graded system of teaching will utilize these services in the associated hospitals and will result, it is hoped in the output of a high grade of trained nurses both for private and public need. Never has there been so wide an opportunity for usefulness in many fields as presents itself to the profession of nursing today. The cry for nurses has not been quieted but accentuated since the close of the war.

The better to promote this broader educational movement the University will provide housing and board for student nurses from the date of their admission to the school, thus relieving them from the major expenses of self-maintenance during the preliminary course. The tuition fees of \$25 will be continued. Classes will be entered in each quarter. The first course, under the new arrangement, will begin March 30th. Application for registration should be made at once to Miss Louise M. Powell, Superintendent, School of Nursing, University Hospital, Uni-

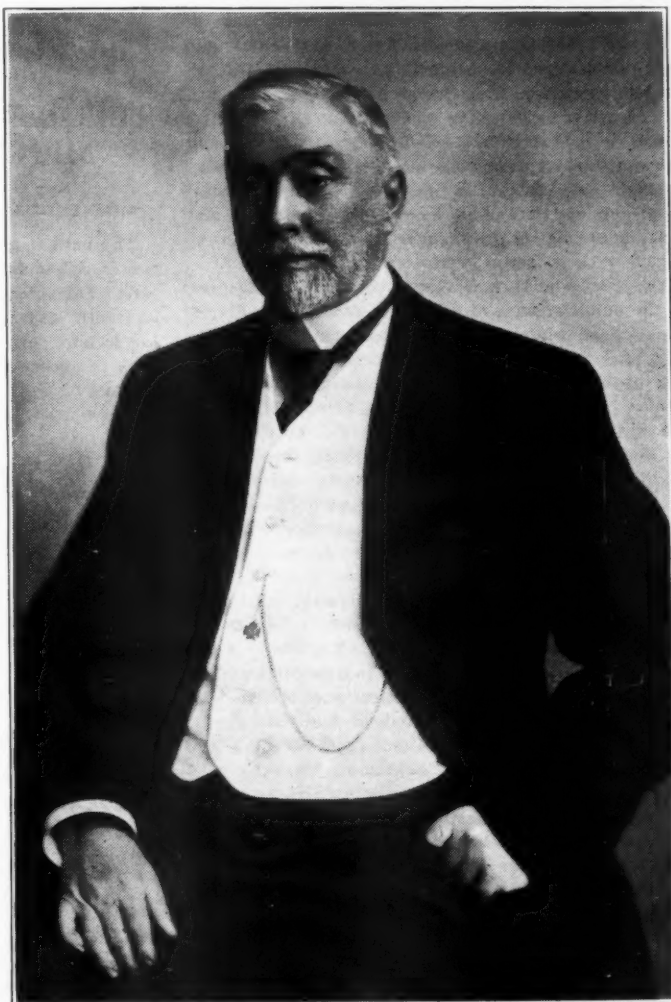
versity of Minnesota, Minneapolis, who will furnish the necessary blanks. High school credentials should be sent to the Registrar of the University. Women of superior education will be especially welcome.

Dr. E. O. Glere of Watertown, S. D. has been appointed Chief of Staff of the St. Paul Hospital, St. Paul, and is opening his office in the Lowry Building. Dr. Glere has been Chief of Staff of the Luther Hospital of Watertown for several years.

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## OBITUARY

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DR. WILLIAM A. HUNT

The untimely death of Dr. William A. Hunt of Northfield, which occurred on Thursday, January 27th, represents a heavy loss not alone to family members, friends and patients but to the medical profession.

Dr. Hunt was one of that older group of medical

men who represent and exemplify all that is highest and best in medical ideals and practice. Our state has been fortunate in possessing so large a number of these individuals who have kept alive the finest of the traditions of our profession; men who did not fail to keep abreast of medical progress and made the practice of their chosen profession their chief purpose in life, yet found time to devote themselves to the public welfare and to the support of all institutions and undertakings operating to benefit their community and the commonwealth.

No medical man is so blest in the love and devotion of his patients as the general practitioner and this statement is peculiarly and particularly true of such as practice outside of the largest cities and are able to come in contact with and to know the great majority of their fellow-citizens.

The writer enjoyed the friendship of Dr. Hunt during a period of over three decades and loved and honored him as a capable, conscientious, and public-spirited physician. His kindness, charity, forbearance and understanding were ever in evidence and it is not strange that the entire community is sorrowing over their loss.

Dr. Hunt was born in Northfield in 1858, educated in the public schools of his native town and at Carleton College where he was graduated in Arts (1878) prior to completing a medical course at the University of Michigan from which he was graduated with honors in 1882. Immediately upon completion of his medical training he returned to Northfield and took up the practice of his profession. From time to time he visited the large medical centers for the purpose of post-graduate instruction and never ceased to be alive to the necessity for keeping pace with the enormous advances made during the past three decades in medicine and surgery.

He was one of the strongest and most influential members of the State Medical Society in which he held one of the vice-presidencies at the time of his death. He had been an active and useful member always of the Rice County Medical Society and was a member of the American Medical Association.

His interest in civic affairs and the love which his fellow-men bore him are well shown by the fact that he was twice elected mayor of his city, to which he gave an extraordinarily competent and effective administration. Always keenly interested in educational matters, he served for fifteen years as a member of the local Board of Education and at the time of his death was serving his second term as President of that body.

In 1920 he lost his beloved wife, whose death was a great sorrow and shock from which he never wholly recovered. Several years ago he was informed that he had serious organic disease but in spite of all cautionary advice he continued actively in the practice of his profession and gave little or no evidence outwardly of the extraordinary draft upon his will-power which the performance of his duties represented.

The profession of medicine will be fortunate indeed if it can maintain in its midst from generation to generation such men as Dr. Hunt.

CHAS. LYMAN GREENE, M. D.

Carl V. Malmgren, M. D., Virginia, Minn.—Ills. 1895; aged 54; died March, 1921.

William L. Hollister, M. D., Austin, Minn.—New York 1861; aged 84 years; a member of the Masons, Elks and Minnesota State Medical Association; died Feb. 25, 1921.

Adolph A. Just, M. D., Crookston, Minn.—Ills. 1881; aged 70 years of age; member of the Odd Fellows, Maccabees, Modern Woodman, Masons, and of the Minnesota State Medical Association; died March 4, 1921.

## REPORTS AND ANNOUNCEMENTS OF SOCIETIES

### MINNESOTA STATE MEDICAL ASSOCIATION

The annual meeting of the State Medical Association is scheduled for August 24, 25 and 26th, at Duluth. The scientific program will be held on the 25th and 26th, and any member of the association desiring to take part is requested to communicate at once with the secretary of either the surgical or medical section.

The officers of the Scientific Section are as follows:

#### Section of Surgery

Dr. John T. Rogers, chairman, Hamm Building, St. Paul.

Dr. T. L. Chapman, secretary, 600 Fidelity Building, Duluth.

#### Section of Medicine

Dr. S. H. Boyer, Chairman, 400 Lyceum Building, Duluth.

Dr. Chas. B. Wright, secretary, 302 Syndicate Building, Minneapolis.

### SOUTHERN MINNESOTA MEDICAL ASSOCIATION

The summer session of the Southern Minnesota Medical Association will take place at Winona, Minnesota, on June 27 and 28, 1921. Members of the association desiring to take part in the scientific program should communicate with Dr. Arron F. Schmitt, secretary general, Mankato, Minnesota.

### EYE SIGHT CONSERVATION COUNCIL

This is a recently formed membership organization, formed to acquaint the public with the importance of eye care and to urge the universal eye examinations of school children, workers in industry and clerks in stores and offices.

The following are the officers:

President:—L. W. Wallace, New York City, who is president of the American Society of Industrial



Engineers and recently elected an officer in the newly formed Federated American Engineering Societies.

Vice President:—Cassius D. Wescott, M. D. Chicago, Ill. Chairmen of Committee on Conservation of Vision of the Council of Health and Public Instruction of the American Medical Association.

Directors:—R. C. Augustine, Decatur, Ill., President of the American Optometric Association. Bailey B. Burritt, New York City, General-Director New York Association for Improving the Condition of the Poor. R. M. Little, New York City, Director of the Safety Institute of America.

Board of Councillors:—Dr. Thos. D. Wood, Teachers College, Columbia University. Dr. Frederick R. Green, Chicago, Ill., Dr. W. S. Rankin, Raleigh, N. C., Arthur L. Day, Ph., Washington, D. C., Dr. Allen McLoughlin, Washington, D. C.

Guy A. Henry Times Building New York City is the General Director.

## OF GENERAL INTEREST

Dr. J. J. Donovan, of Litchfield, has gone to Arizona for his health.

Dr. Werner Hempstead, of the St. Cloud State Reformatory, visited Brainerd recently.

Dr. Thos. A. Lowe, of Pipestone, was recently elected County Physician for the ensuing year.

The Miller Clinic, of St. Paul, opened its new offices in the Hamm Building on February 28, 1921.

Dr. B. V. Bates, of Wheaton, is taking post-graduate work in St. Paul with the leading eye specialists of that city.

Dr. Carl O. Estrem, of Fergus Falls, has gone to Chicago where he will take up a short course in X-Ray work.

Dr. V. E. Verne, of Moorhead, has returned from California where he has spent the past two months with his family.

Dr. M. O. Oppegaard, formerly of New London, Minn., is now associated with the Northwestern Clinic, at Crookston.

Dr. G. W. Snyder is leaving Belle Plaine, Minnesota, to become associated with Dr. Plondke, at St. Paul, in medical work.

Admission is granted to graduates or senior nurses of approved training schools who have the necessary high school requirements.

The annual meeting of the Resident and Ex-Resident Physicians of the Mayo Clinic will be held in Rochester, May 18 and 19.

Dr. John Haskins has taken over the offices of Dr. Adams, of Morgan, and will engage in the practice of medicine at that place.

President Ray Lyman Wilbur, of Leland Stanford University, delivered a Mayo Foundation Lecture on botulism, Saturday, March 5.

Dr. L. F. Woodworth, of Le Sueur Center, was called to St. Paul recently by the sudden death of his mother, Mrs. L. H. Woodworth.

Dr. and Mrs. H. P. Dredge, of Sandstone, are in Chicago where Dr. Dredge is taking a month's post-graduate work at one of the medical hospitals.

Dr. M. S. Henderson, of Rochester, and Dr. F. J. Gzenslen, of Milwaukee, recently visited Dr. Steindler at the University of Iowa Hospital, Iowa City.

Dr. Howard S. Clark, of Minneapolis, specialist in diseases of the eye, ear, nose and throat, announces the removal of his offices to 607 La Salle Building.

Dr. G. Carl Huber, Professor of Anatomy of the University of Michigan, gave a Mayo Foundation Lecture, "Experimental Observations on Bridging Nerve Defects."

Dr. Robert Emmett Farr, of Minneapolis, gave an address on Local Anesthesia at the annual meeting of the Brooklyn Surgical Society held in Brooklyn on March 3rd.

An extensive program has been laid out covering the various fields of medicine and surgery. The names of numerous national celebrities appear in the tentative program.

Dr. F. A. Swartwood and Dr. Bernard Gallagher, of Rochester, have formed a partnership and will engage in the practice of medicine and surgery at Waseca, Minnesota.

Dr. Wiese, who has been a Fellow in Surgery in the Mayo Foundation since 1918, is leaving for his home in Christiania where he will practice surgery in the City Hospital.

Dr. Searles, formerly of Lakefield, Minn., has become associated with Dr. I. J. Murphy, Besse Bldg., Minneapolis, who makes a specialty of X-Ray work and radium treatment.

Dr. Lockwood and Dr. Hartman of the Mayo Clinic, have been called to Mexico City by President Obregon because of the illness of General Hill of the United States Army.

Dr. A. F. Schmitt, of Mankato, has been appointed a member of the State Board of Medical Examiners by Governor Preus. Dr. Schmitt succeeds Dr. E. J. Holman, whose term has expired.

Dr. Oliver S. Ormsby, well known Dermatologist connected with the Rush Medical College of Chicago, was a recent guest of honor at a dinner given by Dr. and Mrs. John H. Stokes, of Rochester.

Dr. Arthur E. Guedel, of Indianapolis, has recently opened offices in the La Salle Building, Minneapolis, where he will engage in the practice of General Anesthesia and Anesthetic Consultation.

Dr. Edward Lissack, of Concordia, Missouri, a specialist in ear, eye and throat diseases, will be associated with Dr. H. A. Miller, of Waseca. Dr. Lissack is a graduate of the University of Nebraska.

Rushmore, Minnesota, is without a physician following the departure of Dr. Tiedemann for Heron Lake, where he has entered into partnership with Dr. Chadbourne, who conducts a hospital at that place.

Dr. Henry Houghton, Director of the Pekin Medical School of the Rockefeller Foundation, has left re-

cently for China. He visited the Mayo Foundation Graduate Medical School in Rochester early in March.

Dr. J. H. James, of Mankato, attended a recent banquet given in his honor at the Minneapolis Club, Minneapolis, by the Minnesota Ophthalmological and Oto-Laryngological Society, of which he is a member.

Dr. C. O. Wright, of Luverne, was recently called to Hastings by the very sudden death of his mother.

Dr. C. M. Niles recently returned to Cottonwood where he will engage permanently in the practice of medicine.

Dr. Clifford E. Henry, of Minneapolis, has been awarded a fellowship in the American College of Physicians. He recently attended the American Congress of Internal Medicine at John Hopkins University, Baltimore.

Dr. J. Whitridge Williams, Professor of Obstetrics in and Dean of John Hopkins University Medical School, gave a Mayo Foundation Lecture, "A critical review of twenty-one years' experience with cesarean section," March 10.

Dr. J. P. Chance, of International Falls, has recently received an appointment in the War Risk Insurance Bureau, and will move to Washington, D. C. Dr. Chance served as a surgeon in the World War, and at the time of receiving his discharge held the rank of major.

Rochester recently entertained a large number of distinguished medical men from all over the country who were en route to Chicago to attend a convention on medical education. Dr. and Mrs. W. J. Mayo were hosts at a luncheon which was attended by over a hundred people.

Dr. McRae, who left Rochester February 1920 to enter service with the American Red Cross, has returned to his Fellowship in the Mayo Foundation. He did relief work in France, Belgium, Germany, Latvia, Esthonia, and Finland, and returned to the United States via Norway and Sweden.

Dr. Frederick L. Hoffman was recently a guest of the Mayo Foundation. Dr. Hoffman, who is statistician of the Prudential Insurance Company and author of *The mortality from cancer throughout the world*, has been attending the meeting of the Council on Education of the American Medical Association in Chicago.

Dr. Harry Pratt Judson, of the University of Chicago, and Dr. Arthur Dean Bevan, Professor of Surgery of Rush Medical College and Chairman of the Council on Medical Education of the American Medical Association recently visited the Mayo Foundation to study the methods of graduate teaching employed there.

The Medical School of the University of Minnesota announces short courses for General Practitioners beginning May 2 and lasting until May 28th, 1921.

It is a matter of interest to note that a post graduate course in medicine and surgery at the John A. Andrews Memorial Hospital, Tuskegee Institute, Ala-

bama, is scheduled for the four weeks beginning April 4, 1921.

This work for the development of public health nurses is being done in a very quiet, but effective way and is directly meeting the public need. Already 118 women have taken these courses. Application for entrance should be made to Miss Louise M. Powell, Superintendent, School of Nursing, University Hospitals, Minneapolis.

Professor Gaston Labat, special lecturer on anesthesia in the Mayo Foundation, has just received notice from the Faculty of Medicine of the University of Paris that he has been awarded the medal for his thesis in paravertebral anesthesia in gastrointestinal surgery. This confers on him the title of Laureate of the Faculty of Medicine of the University of Paris.

Dr. Judson and Dr. Bevan addressed the Fellows and Staff of the Foundation. Dr. Judson spoke on the work of the Rockefeller Foundation with special reference to the work in China. Dr. Bevan discussed the facilities for graduate and undergraduate medical instruction in the University of Chicago and stated his belief in the promising future of graduate medical education in this country.

The Soo Line has signified its willingness to put itself at the service of any Minnesota physicians who contemplate attending the A. M. A. meeting at Boston in June, to the extent of quoting fares and schedules, and if the number attending warrants, furnishing a special through-car. Communications should be addressed to H. M. Lewis, General Passenger Agent, Soo Line, Minneapolis.

Dr. Harry B. Zimmerman, of St. Paul, has been appointed Chief Surgeon for the Great Northern Railway. Dr. Warren A. Dennis and Dr. John Rogers are consultants, and Dr. H. E. Hullsick is assistant. The surgical cases will be cared for at the new Miller Hospital in St. Paul. Dr. James A. Quinn, of St. Paul, has resigned as chief surgeon on account of poor health and is spending the winter in Florida.

Dr. Walter R. Parker, Professor of Ophthalmology in the University of Michigan and Dr. Walter B. Lancaster, of Boston, were guests of the Section on Ophthalmology, at the Mayo Clinic last Tuesday. Dr. Parker is chairman of the committee on membership and Dr. Lancaster is chairman of the committee on the scientific program of the International Congress of Ophthalmology to be held in Washington, D. C., in 1922.

In view of the continuing active demand for public health nurses the University of Minnesota will offer a third four months' course in Public Health Nursing, commencing May 1st. This is the first half of the full eight months' course in this subject. Lectures are given in the Medical School and in the Departments of Sociology, Economics, etc. Field work is provided through the rural model practice field in Hennepin County and by the courtesy of the Associated and United Charities of the Twin Cities, the Infant Welfare and Children's Protective So-

cieties, the Visiting Nurses' Association, the Public Schools, and a number of industrial corporations.

The Mayo Foundation entertained three prominent guests the week-end of March 12, Dr. James Ewing, President Vincent, and Dr. Charles Choyce. Dr. Ewing, Professor of Pathology at Cornell University, delivered a lecture, "Newer aspects of the clinical study of malignant tumors." President Vincent, of the Rockefeller Foundation, discussed the activities of the Foundation in foreign fields, particularly China. Dr. Choyce, Professor of Pathology in the University College Hospital Medical School, London, spoke of the evolution of the fulltime teaching in clinical subjects in English medical schools.

The New York Post-Graduate Medical School and Hospital announces that there will be available this year six scholarships under the terms of the Oliver-Rea Endowment. The purpose of the endowment is to award scholarships to practicing physicians of the United States to defray in full the expenses of tuition at the New York Post-Graduate Medical School. According to the wishes of the donor, physicians in the state of Pennsylvania will receive preference in the award of these scholarships. Applications may be sent to the president of the New York Post-Graduate Medical School and Hospital, 20th Street and Second Avenue, New York City.

The following delegates to the Conference on Medical Education which was held in Chicago, March 7 to 10, visited the Medical School of the University of Minnesota March 4 and the Mayo Foundation March 5. Dr. William Darrach, Professor of Clinical Surgery, and Dr. J. W. Jobbing, Professor of Pathology, Columbia University, Dr. F. T. Van Beuren, of New York, Dean A. S. Begg Harvard Graduate School of Medicine, Dr. William Ophuls, Professor of Pathology and President R. L. Wilbur, Leland Stanford Junior University, Dr. William Pepper, Dean University of Pennsylvania, Dr. O. S. Ormsby, Professor of Skin and Venereal Diseases and Dr. G. E. Shambaugh, Professor of Laryngology and Otolaryngology, Rush Medical College, Dean George M. Kober, Georgetown University, Washington, D. C., Dr. D. R. Joseph, Professor of Physiology, Dr. M. G. Seelig, Professor of Surgery, St. Louis University, Dr. N. Allison, of St. Louis, Dr. L. Crummer, Professor of Clinical Medicine, University of Nebraska, Dr. H. E. French, Dean of the University of North Dakota, and Dr. C. P. Lommen Dean of the University of South Dakota.

The University of Minnesota Medical School through the administrative agency of the General Extension Division will offer to the physicians of the Northwest four short courses to be conducted during the month of May, 1921. Each of these courses will occupy the full working time of the student during the period May 2 to May 28 inclusive. The purpose of these short courses is to help the general practitioner to bring his knowledge up-to-date and especially to make him acquainted with recent progress and new procedures, which only the most

painstaking study of the literature of the day can bring out. It is proposed to offer courses in Pediatrics, Obstetrics, Medicine, and Surgery.

*Pediatrics*.—A course in Disease of Children with special attention to the latest ideas on Infant Feeding and the methods of organizing and conducting Infant Welfare Clinics. Recent developments in Pediatrics will be brought out through practical and systematic lectures and clinics. The teaching staff will include some of the leading specialists of the Twin Cities.

During this course a Child Welfare campaign will be outlined and advice and suggestions offered for its efficient conduct and management.

*Obstetrics and Gynecology*.—A practical classroom and clinical short course planned for the purposes (1) of giving a "brushing up" for the general practitioner in his knowledge of Obstetrics and Gynecology; and (2) of presenting recent developments in these subjects so that the general practitioner may return to his practice with the latest views and procedures.

*Medicine*.—Lectures, demonstrations, and clinics covering the newer methods of diagnosis and treatment by specialists in the several fields; diagnosis and treatment of diseases, of metabolism, of the renal disorders, of the anemias, of gastrointestinal diseases, and of mouth infection as related to general medicine; tuberculosis, cardiac disorders, diseases of the spinal cord, encephalitis lethargica, syphilis, and the consideration of some interesting dermatologic problems. A venereal disease campaign will be outlined.

*Surgery*.—General surgery covering operative surgery on cadaver and animal in the surgical laboratories; demonstrations and clinics at the University, Minneapolis General, City and County Hospitals; diagnostic and operative clinics in minor surgery at the Out-Patient department of the University; lecture course on surgery of the extremities; lecture and demonstration course in Proctology. There will also be lectures and clinical demonstrations in Urology, Orthopedics, and Roentgenology.

*Combined Course*.—Practitioners who do not wish to limit their work to one subject may register for a combined course selected from the offerings of the several departments.

*Registration*.—The four courses outlined above will be conducted synchronously during four weeks. Other departments of the Medical School will also put on special work during the time these courses are running, for the benefit of the men who care to take advantage of the opportunity to get some work in other lines. Any physician may register for any one of the four four-weeks courses outlined above, or he may register for any one-week unit of any course. In other words a physician may plan to spend one, two, three, or four weeks at the University and he may follow one line or several lines; it is recommended, however, that he pursue a full four-weeks course. No one of these courses will be

conducted for fewer than six men and not more than twenty registrations will be accepted for any course.

*Fees.*—The fee for any unit four-weeks course is \$30.00. The fee for any one-week course is \$10.00. There will be an extra charge for laboratory material.

*Place.*—Lectures, demonstrations, and clinics will be held in the medical buildings of the University of Minnesota, the University Hospital, and at the various other hospitals of the Twin Cities.

## CORRESPONDENCE

The Duluth Clinic,  
600-700 Fidelity Building,  
Duluth, Minn., March 7, 1921.

Editor Minnesota Medicine,  
St. Paul, Minn.,

I wish to draw your attention to something that might be of interest for Minnesota Medicine. Some days ago a trained nurse, who has been active in the profession for over thirty years, handed to me a clipping from a Duluth paper, that has to do with the report of a banquet of the Minnesota State Medical Society. Unfortunately, the date is not given, and the clipping is somewhat torn. Nevertheless, of striking interest is the reference to the late Dr. Burnside Foster of St. Paul.

There are many men still in the profession who will no doubt recall the meeting, and recall the toastmaster. Some will readily know whether the excellent poem entitled "The Doctor at the Parting of the Centuries" was original with him or not. Those of us who have come on and who knew Dr. Foster only in his later years, still knew him well enough to feel that it was quite within his wonderful powers to have been not only the author but everything as a presiding officer that the reporter acclaimed.

I feel that the clipping is worthy of reproduction because it draws to our attention altogether too poignantly the absence from our meetings in recent years of the late Dr. Foster's type. Whether our medical curricula are too crowded to permit the proper admixture of the historical, the social or the "broad humanities", is difficult to state. Nevertheless, it is an evidence that we should not be proud of, that our regular medical banquets favor far more of caloric hyperbole than the spiritual touch. There are those who will at once fly to the Volstead amendment as the explanation, but this much discussed arid movement is not the answer; this is not a scholarly age.

E. L. TUOHY.

Following is the clipping mentioned:

### THE BANQUET

VISITING PHYSICIANS ARE ENTERTAINED WITH A FEAST  
AT THE SPALDING

The members of the Minnesota State Medical Society were entertained at a banquet given at the Spalding last evening by the local members of the society. It was a very happy affair for the men of the

medical profession are a very genial and fraternal lot of gentlemen. There is a warmth, in fact, a brotherly feeling among them and the annual association with each other is an event which is always looked forward to with pleasant anticipations. The members who attended regularly are the ones who experience the greatest regret at inability to attend. The list of speakers who were to respond to toasts was considerably broken in upon, four of the seven requiring substitutes.

The Spalding served a fine repast and after it had been disposed of by men for whom indigestion seems to have no terrors the feast of reason was given full sway. Flaaten's orchestra played. Dr. Burnside Foster, of St. Paul, was the toastmaster. He is a man of fine presence, excellent composure and presides over a function such as that of last evening with rare tact and grace. His own response was to the toast "The Doctor at the Parting of the Centuries," and he responded in verse as follows:

"To cure their ills and guard the people's health,  
Brings little fame and scarcely more of wealth.  
'Tis rare indeed that on the roll of fame  
We find inscribed the busy doctor's name.  
Nor is it wrought in gold or carved in stone  
Few poets have writ the deeds by doctors done.  
To worship heroes and to sing their praise,  
To tell of love in many different ways,  
Of human happiness and human grief,  
All this has been of poetry the chief;  
And yet methinks, the greatest theme of all  
Has been neglected, and scarce sung at all.  
Who of all men sees most of all these things?  
Who of all men to those who suffer brings  
Most comfort, most relief from pain?  
Whose is the helping hand ne'er sought in vain?  
Ask of yon happy little lad  
Whose legs were crooked and whose back was bad,  
Who made him straight and put his back at rest?  
Ask of some mother at whose happy breast  
A new born babe is held with joy and pride,  
Who sat beside her and to whom she cried  
For help and comfort in her hour of pain?  
And ask her if she ever cried in vain?  
Ask of the soldier back from some campaign,  
To whom he owes it that he's home again?  
Ask him who ran to help him when he fell,  
Who snatched him from the very jaws of Hell,  
Where bullets rained and shells were bursting round  
And dead and dying cumbered all the ground?  
When pestilence and plague with horrid breath  
Are stalking through the land and dealing death,  
Who faces them without a thought of fear?  
Whose is the voice the sufferer loves to hear?  
All these the doctor does, has done, will ever do;  
These are his duties and his pleasure too;  
Not that he loves to see and hear the pain,  
But loves to make the sufferer smile again.  
Loves to wipe tears away, to hush the cry  
Of anguish; or, if need be, make it easier to die.  
And yet they tell us that no doctor's name



Deserves a tablet in the Hall of Fame.  
 What in this Century, now almost dead,  
 Have doctors done? Let History be read.  
 The curse of smallpox for a thousand years  
 And more, had filled the world with tears,  
 Then Jenner came and taught mankind  
 The secret—and the curse was left behind.  
 Not quite behind, for some poor fools refuse  
 The proffered gift and fain would choose  
 To die or suffer and bear horrid scars.  
 Thus ignorance the way of progress bars.  
 Scarce one of us now living can recall  
 The awful tortures of the hospital,  
 When patient's shrieked beneath the surgeon's knife  
 When cruel pain alone could save the life.  
 But, thanks to Morton, Jackson, Simpson, Long,  
 To each some share of glory shall belong,  
 The pain is banished and the knotted brow  
 Of agony, is smooth and peaceful now.  
 Nor was the pain the only thing to fear,  
 The suffering patient had still more to bear;  
 The fevered wound which oft refused to close,  
 Prolonged the period of the sufferer's woes.  
 Then Pasteur, Tyndall, Lister came upon the scene  
 And surgeons learned the art of being clean.  
 These things have doctors done and many more.  
 What of the future? What has she in store?  
 I dare not say—I dare not even guess.  
 And yet I know that it shall not be less.  
 A century is past, and now we stand before  
 The twentieth century's slowly opening door.  
 Then let us vow before the old is past,  
 To make the next more glorious than the last."

President Walter Courtney, of Brainerd, was to have responded to the toast "The Minnesota State Medical Society," but Dr. F. A. Dunsmore was substituted, etc.

[The above poem was written by Dr. Burnside Foster and published in the St. Paul Medical Journal August 1900. Its composition was suggested by the fact that no medical man's name had been suggested in the numerous lists submitted of names worthy to be placed in the Hall of Fame to be erected under the direction of the University of New York. Recently Dr. Morton's name has been placed in the Hall of Fame.—Ed. Note.]

#### CORRECTION

Regrettable errors occurred in the article entitled "Electrocardiograms in Thyrotoxic Conditions" by George C. W. Stein, M. D., which appeared in our February issue.

Upper figure on page 84 should read:

Case 1 Fig. III Case 1

Lower figure on page 84 should read:

Case 1 Fig. IV Case 2

Lower figure on page 85 should read:

Fig. III Case 8

In the paper entitled "Fractures of the Base of the Radius" by Dr. Roscoe C. Webb, which appeared in

our February number, the following legends were unfortunately omitted:

Fig. 1. X-ray of anatomical specimen with pieces inserted showing the limits of articular surfaces of radius and ulna. Triangular fibro cartilage of ulna can be seen.

Fig. 2. X-ray of anatomical specimen, lateral view. Arrows A B show the normal inclination of the radial joint surface.

Fig. 5. Fracture of base of radius showing altered radial inclination, arrows X Y. Lines A B show the normal inclination.

## NEW AND NON-OFFICIAL REMEDIES

During February the following articles have been accepted by the Council on Pharmacy and Chemistry for inclusion in New and Non-official Remedies:

**Armour & Co.**

**Corpus Luteum Tablets, 5 grains.**

**David B. Levy:**

**DuBois Iodoleine, Injectable, Ampoules, 2 Cc.**

**E. R. Squibb & Sons:**

**Fat-Free Tincture Digitalis.**

#### PROPAGANDA FOR REFORM

**Metol Dermatitis.**—Workers in photographic establishments, especially those engaged in the developing process, are exposed to a number of industrial poisons. In an examination of forty studios in Chicago there were found thirty-one cases of poisoning by metol (the trade name for mono-methyl-para-amido-meta-cresol sulphate), characterized by an erythematous rash of the hands and arms, occasionally involving other parts of the body and giving rise to ulcers. Various methods for the prevention of this dermatitis and for its treatment are published (Jour. A. M. A., Feb. 19, 1921, p. 540).

**Iron Arsenite.**—Ferric arsenite (iron arsenite) rendered water soluble by means of ammonium citrate is known as ferric arsenite soluble. The Council on Pharmacy and Chemistry in 1912 reported that the preparation was irrational and unscientific because "one cannot, in administering this drug, give a useful dose of iron without giving too much arsenic and, vice versa, one cannot give a safe dose of arsenic without giving too little iron" (Jour. A. M. A., Feb. 19, 1921, p. 540).

**Medicinal Use of Whisky.**—In the twenty-four states of the union in which permits for the prescribing of whisky may be issued, there are 112,238 practicing physicians. Of these only 33,379 (29 per cent) have taken out permits. Evidently the remaining 71 per cent do not regard whisky as of enough value in the practice of medicine to go to the trouble of taking out a permit (Jour. A. M. A., Feb. 19, 1921, p. 524).

**Sodium Cacodylate, Arrhenol and Mon-Arsone.**—At least three arsenicals not of the arsphenamine type

have in recent years been the subject of some exploitation for use in the treatment of syphilis, namely, sodium cacodylate, Arrhenol (the sodium salt of methyl arsenic acid) and Mon-Arsone (the sodium salt of ethyl arsenic acid). As to the first two, it was shown several years ago that neither had any action on trypanosomiasis or spirochete infection. The inefficacy of sodium cacodylate in human syphilis has been demonstrated clinically. Animal experiments made in the United States Hygienic Laboratory have demonstrated that Mon-Arsone is devoid of any practical trypanocidal action. Many drugs cause temporary improvement in syphilis, but so far only those arsenicals related to arsphenamine have proved of real value and comparatively safe (Jour. A. M. A., Feb. 26, 1921, p. 595).

**Diphtheria Antitoxin and Diphtheria Bacilli.**—The well established curative properties of diphtheria antitoxin must not be confused with its possible value as a prophylactic against the disease. Attempts have been made to apply diphtheria antitoxin locally in the pharynx and nares with the hope of eradicating the objectionable micro-organisms that may have found lodgment there. Recent investigations to determine the effect of diphtheria antitoxin in preventing lodgment in and growth of the diphtheria bacilli in the nasal passages of animals were entirely negative (Jour. A. M. A., Jan. 1, 1921, p. 41).

**Echinacea.**—Intelligent members of the medical profession must be well aware that both the Pharmacopoeia of the U. S. and the National Formulary include many products that can scarcely be justified as medicinal on the basis of scientific consideration. Among the products included in the National Formulary is the fluidextract of echinacea. In 1909 a report of the Council on Pharmacy and Chemistry denied echinacea a place in New and Non-official Remedies because there was no evidence to show that it possessed therapeutic value. Despite this, echinacea is used extensively. The fluidextract and the tincture are made in enormous quantities, and the root enters into the composition of a large number of "patent", proprietary and non-secret mixtures. For this reason Couch and Giltner of the U. S. Bureau of Animal Industry made an extensive experimental study of echinacea therapy. Animal experiments designed to determine whether the drug possessed the properties that are ascribed to it gave negative results in every instance (Jour. A. M. A., Jan. 1, 1921, p. 39).

**Serums and Vaccines in Therapy.**—In the development of serums and vaccines, scientific investigation and experimentation have preceded clinical tests of those products which have proved of permanent worth. Whenever the clinical use of serums and vaccines has proceeded beyond well established facts determined by laboratory research, the result, has usually been disappointing. To submit a serum or vaccine for clinical trial without successful preliminary laboratory investigation of its probable worth

is an imposition on the profession. The success of diphtheria antitoxin and antityphoid vaccine has prejudiced the profession and public in favor of vaccines and serums so that they are willing to accept a new serum or vaccine simply because it is a serum or vaccine. In his introduction to a series of articles on serum and vaccine therapy which is now being published by the Council on Pharmacy and Chemistry, Flexner points out that in only a few instances has the anticipation been realized that a curative antiserum for each disease would be discovered. The history of antipneumococcus serum affords a striking example of the difficulties and pitfalls that are encountered in the development of remedies of this class. Thus far only one therapeutically active serum, Type I, has been developed, and this serum is not effective against infections by other types of pneumococci. Despite this, we are being offered today for clinical use "polyvalent" antipneumococcal serums recommended by the makers for the use in all types of pneumococcus infection (Jour. A. M. A., Jan. 8, 1921, p. 115).

**Polyvalent Vaccines for Colds.**—At least five commercial manufacturers of biologic products make and push the sale of vaccines to prevent colds. Of these at least two, from time to time, have added new strains of bacteria to the formulae with which they originally introduced their products, so that seventy-five or eighty different types of bacteria are now included. Every year different types, varieties and species of bacteria have been associated with colds in different parts of the country. Presuming—although it has never been proved—that any vaccine has value in preventing colds, the logical thing to do is to prepare a specific vaccine for each form of cold in each part of the country. Commercially it is much more profitable to mix all the bacteria together, to prepare a vaccine and to inject this into the patient in the hope that some organism will produce antigens which will find their mates. The present day shotgun biologic mixture is more ridiculous than the old shotgun proprietary—and a greater menace to public health and to scientific medicine (Jour. A. M. A., Jan. 15, 1921, p. 182).

**Helmitol omitted from N. N. R.**—Helmitol is hexamethylenamin methylencitrate. It was introduced with the claim that it was superior to hexamethylenamin (which acts in acid fluids only) in that it is equally efficient whether the urine is alkaline or acid. In 1918 the Bayer Co., which then marketed the product in the United States, was notified that the Council on Pharmacy and Chemistry questioned the claims and desired evidence for their substantiation. In 1919 the same notification was sent the Winthrop Chemical Co., which in the mean time had secured control of the product. Pending the submission of evidence, the Council continued Helmitol in New and Non-official Remedies with the statement that the action and uses were those of hexamethylenamin. Now the Council on Pharmacy and Chemistry announces that Helmitol has been omitted from New

and Non-official Remedies for the reason that the claims under which it was introduced have been disproved by P. J. Hanzlik, who demonstrated that the alkalinity required to split off formaldehyd from helmitol is greater than exists in urine, even in the advanced ammoniacal fermentation (Jour. A. M. A., Jan. 22, 1921, p. 260).

## PROGRESS

Abstracts to be submitted to Section Supervisors.

### MEDICINE

#### SUPERVISORS:

F. J. HIRSCHBOECK,  
FIDELITY BLDG., DULUTH,  
THOMAS A. PEPPARD  
LA SALLE BLDG., MINNEAPOLIS

**THE CEREBROSPINAL FLUID IN EPIDEMIC ENCEPHALITIS:** Piero Boveri (Milan, Italy) (Jour. of Nerv. and Mental Dis., Oct., 1920). When the epidemic of lethargic encephalitis made its appearance, early clinical observers noticed the striking fact that in spite of the sensorium changes and other symptoms often appearing in acute meningitis the spinal fluid showed apparently no changes from the normal findings. Dr. Boveri has completed a study of cerebrospinal fluid in sixteen cases. These fluids were taken from the fifth to the thirty-fifth day of the illness. Thirteen of these cases were of the classical type. Two were of the myoclonic type and one was a mixed type. Increase in the pressure of the spinal fluid was very slight. When present, it would occur only in the most acute stage of the illness. The color of the fluid was always clear. As for albumin and globulin content, the strong positive reaction could never be obtained. In two cases a very slight increase up to 0.25 per cent was found. The reducing power was increased in eleven cases and normal in four. Lymphocytosis also was found to be very slight; fourteen per c.m.m. was maximum obtained. A leucocytosis was found in twelve cases, increased to the extent of 4 to 6 per cent only. The author states "All these factors being slight, they can only be detected by most accurate examination, otherwise they may easily pass unobserved."

The following summary is given:

1. The cerebrospinal fluid in encephalitis patients is not to be considered normal.
2. The alterations of the liquid are always slight either in connection with the cytological examination or in connection with the presence of albuminoids, and with reducing power.
3. In all phases of the disease the liquid always shows the same slightness of alterations in its initial phase, however, it shows its anomalies more easily.
4. The different clinical types of epidemic encephalitis (lethargic form, myoclonic form, mental

form) show no particularly characteristic cerebrospinal fluid.

5. The slightness of the alterations and their uniformity in all phases of the disease are facts of great importance, especially in view of diagnosis of epidemic encephalitis, so that it may be possible to differentiate this disease from the different forms of meningitis, particularly from tuberculous meningitis and syphilitic meningitis.

J. C. MICHAEL

**DIABETES INSIPIDUS, GLYCOSURIA AND THOSE DYSTROPHIES CONSIDERED AS HYPOPHYSAL IN ORIGIN:** Drs. Camus and Roussy. (Endocrinology—Oct.-Dec., 1920.) "Diabetes Insipidus and that which is termed 'Hypophyseal Polyuria.'"

From a series of animals used in a study of the relation of polyuria to the removal of the pituitary body, the two following cases are selected. Hypophysectomy was practiced on two dogs, the removal being equally complete. One showed notable polyuria; the other not a trace. Autopsies showed in the first case, injury to the base of the brain; in the second, it was intact.

Five operations performed on dogs, on which the region of the base of the brain which borders on the pituitary body was injured with a hot needle (the pituitary body remaining uninjured) resulted in marked polyuria. Two other dogs were operated, removing the pituitary body. The removal was followed by fleeting polyuria. A second operation was then performed at which the base of the brain was injured. This was followed by a more marked polyuria than was seen after removal of the pituitary body. Autopsy showed in both cases double injury to the base of the brain. The duration of polyuria so produced is variable, fleeting or permanent. Some last 15 days, some as long as 8 months. Use of pituitary extracts in no way affected the polyuria.

The lesion which determines polyuria does not concern the pituitary body, nor does its involvement increase or diminish the polyuria. The depth of puncture, involvement of optic thalamus or peduncle, does not alter the polyuria produced. The vital zone is the opto-peduncular region, which lies at the level of the grey substance of the tuber cinereum in the vicinity of the infundibulum. Here a superficial lesion is all that is required. A lesion in front of this zone at the level of the chiasm, or back of it, at the level of the protuberance gives no polyuria.

To determine whether polyuria is primary or consequent to polydipsia, animals were put on constant fluid intake. Polyuria appeared and in some cases the urine increased in volume beyond that of fluid intake. The conclusion was reached that polyuria was primary.

In considering "Glycosuria of Hypophyseal Origin," 45 dogs and 9 cats were operated. Six of the dogs showed light, fleeting glycosuria, lasting no longer than 36 hours, and independent of the polyuria.

In these six cases, no condition was produced at operation nor demonstrated at autopsy which was not repeated many times in the 39 negative cases. The glucosuria in all cases followed rapidly after operative shock. It could not be demonstrated that it was the result of injury to the base of the brain or injury to removal of the pituitary body. Neither did such operations appreciably influence carbohydrate tolerance nor the appearance of alimentary glycosuria, nor was the latter influenced by any of the preparations of whole gland or extracts of anterior or posterior lobes.

ROBERT HELM KENNICOTT

**THE NEED OF EARLY DIAGNOSIS AND TREATMENT OF CHOLEDOCHITIS, CHOLECYSTITIS AND CHOLELITHIASIS:** B. B. Vincent Lyon, (Ann. of Med., July, 1920) emphasizes the importance of a greater knowledge of the physiology and pathological physiology of the first two parts of the duodenum and the secretions (and excretions) of the stomach, liver, gall bladder, pancreas and duodenal mucosa discharging therein, as a means of early diagnosis and differentiation of disease in this part of the alimentary tract.

The use of the duodenal tube has added greatly to our knowledge of diseases of this region, especially of the biliary system, and has made possible earlier diagnosis than by surgical and roentgenological examinations. Likewise, unnecessary surgical interference has been avoided.

Meltzer showed that according to his "Law of Contrary Innervation" the gall bladder could be emptied by introducing directly into the duodenum solutions of magnesium sulphate, this causing a relaxation of the duodenal wall and Oddi's sphincter of the common duct, and permitting the discharge of bile into the duodenum.

The writer found that by introducing magnesium sulphate solution directly into the duodenum, which was previously bile free, he could recover, by means of the duodenal tube, bile which underwent certain definite changes in color and viscosity—"first a light lemon to golden yellow, then a deeper, richer, more syrupy golden yellow, and finally to a very uniformly light lemon yellow, thinner and less syrupy than either of the first two, and that this sequence occurred in all normal cases."

In cases of gall bladder disease the second deep golden yellow bile was replaced by very viscid, deep greenish-black bile, microscopically and culturally corresponding with bile obtained from gall bladder later at operation.

He states, "with certain exceptions, it is possible to drain the gall bladder wholly or partially of its fluid contents; to drain the bile ducts and to obtain bile freshly secreted from the liver cells and to separate these several biles into individual bottles for examination."

The method of procedure is described in detail.

Diagnosis is then developed around the micro-

scopical and cultural study of the bile and the manner of its discharge. Differential diagnosis depends on these studies. This method of non-surgical biliary drainage has been used in the treatment of simple *catarrhal* jaundice, *choledochitis*, *cholangitis*, *cholecystitis*, *empyema* of gall bladder and biliary stasis.

He sums up his article as follows: "This method has already achieved a position of importance in the diagnosis of biliary diseases. In the field of treatment it is certainly the method of choice for 'biliary stasis', gall bladder atony, and in the early stages of *catarrh* and infection. It may be found to cut down the incidence of stone formation and thus of cancer of the gall bladder. It may decrease the tendency to damage the pancreas and liver. It may have a place as alternative method of treatment for some of the surgical groups, presenting operative contraindications. It certainly is useful as a post-surgical 'follow up' plan of treatment in many cases."

PAUL G. BOMAN.

**ACUTE INFECTIOUS AORTITIS, WITH REPORT OF CASES:** Brown (Ann. of Med., July, 1920) reviews the medical literature on this subject and presents several case reports. He emphasizes the fact that but scant attention is paid to acute aortitis in American medical literature. He refers to many writers, mainly European, reporting cases of acute aortitis, accompanying or following acute infections.

The pathological findings indicate that in the majority of cases the primary involvement is in the media, with secondary extension to the intima, and that the lesions are inflammatory in character. Localization is generally in the ascending aorta. The tendency in most cases is toward repair and restoration of tissue.

The symptoms are essentially the same for all varieties of acute inflammation of the aorta, although in many cases non-existent or very slight. The more characteristic symptoms, according to importance, are:

(a) Pain—This is typical when present, and due to intra-aortic tension. It ranges from feelings of "tightness," "weight" or "pressure" to angina pectoris. In addition to true pain sensations there is a feeling of dread, fear or mental depression. (b) Dyspnea—May be a presenting symptom, and often marked. (c) Cough—Usually present where the affection is subacute or chronic. It may be due to irritation of the recurrent laryngeal nerve or may occur as a consequence of cardiac insufficiency. (d) Vasomotor Symptoms—Mydriasis and myosis are most constant, and are explained on the basis of sympathetic nerve irritation.

The signs given are: (a) Fever—Variable, but resembles the fever course of endocarditis. (b) Changes in Aorta—(1) Lengthening of aorta, producing elevation of arch. (2) Alteration in width. (3) Alteration in contour of aortic shadow. (4) Tenderness to touch. (c) Pain on deep pressure



over sternum. (d) Auscultation—Of questionable value.

The prognosis is generally good and "restitutio ad integrum" is fairly frequent, except where the aortic valves or the myocardium are involved.

The treatment is essentially the same as that indicated in infective endocarditis, and consists of absolute rest in bed, sedatives, and general eliminative measures.

PAUL G. BOMAN.

## SURGERY

### SUPERVISORS:

E. MENDELSSOHN JONES

LOWRY BLDG., ST. PAUL

VERNE C. HUNT,

MAYO CLINIC, ROCHESTER.

**PERSISTENCE OF PYLORIC AND DUODENAL ULCERS FOLLOWING SIMPLE SUTURE OF AN ACUTE PERFORATION:** R. Lewisohn (Ann. Surg., 1920, 565 to 599). The author mentions the fallacy of the prevalent idea that an acute perforation of an ulcer of the stomach or duodenum will result in the spontaneous disappearance of the ulcer by simple closure. Some surgeons consider that gastroenterostomy is an unnecessary and rather dangerous procedure in these cases. Operative recoveries are not impaired by immediate gastroenterostomy. Shea reported nine consecutive cases of simple closure without a death. Gibson reported fourteen cases with one death; thirteen of these had simple suture. Deaver, who strongly advocates immediate gastroenterostomy, reported twenty-five cases with one death. The author reports ten consecutive cases without a death; gastroenterostomy was done on eight of these patients. Seven patients were later re-examined. Six on whom gastroenterostomy had been done were entirely well. Simple suture had been done on the seventh patient; he had a persistence of gastric symptoms and operation later revealed a perforated duodenal ulcer, walled off by the liver. Recovery followed gastroenterostomy with pyloric exclusion.

Opposition to immediate gastroenterostomy is usually based on the possibility of spreading infection and undue length of operation. If perforation of the ulcer has occurred the peritoneum is already infected and gastroenterostomy does not spread the infection; if peritonitis is localized, the peritoneal cavity can be packed off. Furthermore, gastroenterostomy is quickly performed, and in acute cases a Murphy button may be used. Immediate gastroenterostomy, especially if associated with pyloric exclusion, brings the advantages of simplified after-treatment and the curative effect on the ulcer. Simple closure of the perforation fails to cure in a large number of cases. The author cites four such instances in detail. All the patients had had simple

closure of the perforation and drainage of the peritoneal cavity. In two cases the symptoms persisted for eight and five years respectively, with prompt relief following gastroenterostomy and pyloric exclusion. In one patient the ulcer was excised; a definite ulcer was not found in another, probably because of extensive duodenal adhesions. Drainage of the peritoneal cavity following closure of the perforation is apt to cause adhesions between the pylorus and duodenum and the anterior abdominal wall; gastroenterostomy, however, will safeguard proper drainage in spite of adhesions.

Closure of the perforation, gastroenterostomy, and pyloric exclusion should be the method of choice in the treatment of perforated pyloric and duodenal ulcers.

H. W. HUNDLING.

**GENERALIZED OSTITIS FIBROSA WITH MULTIPLE CYST FORMATION:** Dr. Ernst Wehner, (Forts. a. d. Geb. d. Roentgenstrahlen, Band XXVII, Heft 2.) Since the original observation by Frouriepe in 1842, there have been twelve cases reported in the German literature, of generalized ostitis fibrosa with multiple cyst formation. These are tabulated by the author, with short data concerning the sex, age, most important clinical findings, the site of the cysts, and the histologic findings in the diagnosis of the fundamental bone pathology.

According to the more recent knowledge, these cases would probably all be classified as a generalized form of ostitis fibrosa (von Recklinghausen). In addition, the author presents a case of his own in which he had the opportunity of studying the lesions at intervals of five years.

The patient was a girl, twenty-one years old. At the age of ten months, the patient had rickets. Although as a child she was over-normal in size, she was able to walk first at the age of twenty-one months. At three and a half years, she stumbled over a hazelnut and fractured her left femur. This healed promptly. At the age of ten years, the patient began to limp. The menstrual periods began first at nine and three-quarters years. The patient injured the left femur through falling several times, and suffered considerable pain. Since that time, she gradually improved, until she was practically free of symptoms when she first presented herself for examination in 1914. The roentgen examination at that time showed multiple cyst formation distributed throughout the greater part of the skeletal system. The cysts varied in size from a linseed to a hen's egg. These were associated with structural changes of the bone tissue, there being poorly defined borders between the medullary and cortical portions of bone. The cortex showed thinning and rarefaction and in some places swelling was so marked as to cause the disfiguration of bone.

The roentgen examination in 1919 showed no change except for new cyst formation in the sternum. The old cysts remained the same size. There apparently

had been no attempt at healing, notwithstanding which the patient was entirely free from symptoms during the entire five years.

The author suggests that in this case there may be some relationship between the bone lesions and the infantile rickets, or further it may bear some relation to the disfunction of the ovary as was expressed by the abnormally early onset of menstruation.

The striking feature is that during five years the lesion showed no progress, although at the same time there was no attempt at healing.

With reference to the prognosis, the fact is mentioned that during pregnancy this type of lesion is apt to progress and change over into the more severe form.

R. G. ALLISON

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## GYNECOLOGY AND OBSTETRICS

### SUPERVISORS:

ARCHIBALD L. McDONALD,  
FIDELITY BLDG., DULUTH.

ALBERT G. SCHULZE,  
LOWRY BLDG., ST. PAUL

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**THE DISTRIBUTION OF ADENO-MYOMAS CONTAINING UTERINE MUSCOSA:** Thomas S. Cullen Arch. of Surg., Vol. 1, No. 2). It is not possible to adequately review this exhaustive study in the space here permitted, but every surgeon interested in gynecology should read the original article. One is impressed by the widespread distribution of this form of newgrowth. Detailed descriptions are given of a large variety of such tumors, from the authors collection. They have been found in: 1. body of the uterus, 2. recto-vaginal septum, 3. uterine horn and fallopian tube, 4. round ligament, 5. ovary, 6. utero-ovarian ligament, 7. utero-sacral ligament, 8. sigmoid flexure, 9. rectus muscle, 10. umbilicus. Wherever found, the structure is characteristic. The growth is diffuse, not encapsulated and has a tendency to reach the surface of the invaded organ. Here it stimulates adhesions or extends to neighboring structures. This is most evident in the recto-vaginal septum. Microscopically, there is found, diffuse myomatous tissue with spaces of varying size, lined by columnar uterine epithelium resting on typical stroma. The cavities contain blood, fresh or broken down, forming the characteristic chocolate colored fluid. These areas share in the regular premenstrual congestion, causing increased pain typical of this condition. Operative removal must be complete. Otherwise there is recurrence with widespread growth.

ARCHIBALD L. McDONALD.

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**TREATMENT OF ABORTION:** Hillis (Surg. Gyn. & Ob., Dec., 1920). Two hundred cases of septic abortion were treated in two equal groups, of which

one hundred were curetted and one hundred received only constitutional therapy. The latter patients showed lower mortality, fewer complications, less fever, and shorter average stay in the hospital. 122 cases of non-infected or afebrile abortions carefully studied, demonstrated that: (a) 63 per cent occurred between the second and fourth month and 75 per cent of these were incomplete, (b) 31 per cent were criminally induced and therefore potentially infected, (c) 5 patients who were discharged without having been curetted, returned because of excessive hemorrhage. He concludes that patients with septic abortions should receive no local treatment till they have been afebrile for five days, except in case of severe hemorrhage. 2. Such an afebrile period converts a septic case to a nonseptic one, which should then be curetted as a routine because; (a) 40 per cent of such patients treated expectantly have to be curetted later. (b) Curettage insures an empty uterus and prevents subsequent bleeding. (c) It shortens the stay in the hospital. (d) It is relatively harmless in comparison with the good accomplished.

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### INDICATIONS FOR OPERATION IN SPREADING PERITONITIS OF POST-ABORTAL AND POST-PARTUM ORIGIN:

J. O. Polak, Am. Jour. Ob and Gyn. Nov., 1920). This excellent description of the pathology of these infections, explains the tendency for the process to localize in the pelvis and cul-de-sac of Douglas. The infection reaches the pelvis through the tubes or para-metrium and remains in this region until the period when the uterus has become an abdominal structure, due to adhesions of the sigmoid and omentum shutting off the process. This tendency is enhanced by the Fowler position or "Gatch Frame," but may be seriously disturbed by meddling local treatment. In the post-partum type of infection there is less tendency to pelvic localization or collection of septic material in the cul-de-sac.

Clinically, extension of the process in the peritoneum is characterized by: elevation of temperature, rapid pulse, leucocytosis, with increase in the percentage of polymorphonuclear cells, abdominal pain and distention, with local tenderness. Proper treatment includes; Fowler position or Gatch frame, ice-bags, morphine and proctoclysis and is usually followed by improvement. Spreading peritonitis may be due to unusual virulence of causal bacteria, poor resistance, and imperfect localization. It is associated with: increased local symptoms, higher temperature, rapid pulse, rise in leucocytosis and percentage of polymorphonuclear cells. Polak accepts this complex as indication for surgical drainage, even in the absence of a definitely localized fluctuating mass. This should be secured early in the course of the process, while resistance is still good. In the post-abortion cases the cul-de-sac is opened through the vagina, while in those occurring post-partum with a larger uterus the general abdominal cavity is drained

through one or two stab wounds. Conservative treatment is then carried out.

**INTRA-UTERINE THERAPY IN POST-PARTUM INFECTION OF THE UTERUS:** Henri Vignes (Gyn. et Obste., *Revue Mensuelle* Vol. 2, No. 3.) The author notes the present tendency to avoid all intrauterine therapy and traces the evolution of ideas in practice at the Baudoloue clinic. In 1894, of 123 women with such infection, 85 were treated with intrauterine douche or irrigation and 38 were curetted. In 1909 Pinard concluded "that curettage is rational only in exceptional cases." During 1919 in the same clinic there were but two cases who received any intrauterine measures, namely: digital exploration and douche.

Observation of war wounds brought out two principles: 1. Streptococcus infection of wounds is particularly resistant to local treatment. 2. The only local measure of any value is early and complete excision "en masse" of the area of infection, which in this case would mean hysterectomy. Local measures commonly employed are: Curettage, digital "curage" (cleansing), local application or packing with antiseptics, and irrigations.

Curettage aims to do away with the focus of infection. Retained secundines and clots are removed, but these are relatively unimportant as regards severe infections. Removal en masse of the endometrium involved, has been proven to be impossible, and experience with war wounds teaches that the slightest remnant of infection, leads to rapid extension. Curettage is habitually followed by a rise of temperature, as noted by many French observers, due to massive absorption of toxins through vessels opened up by the curet. It is impossible to prove that the apparently favorable course after curettage is in any case due to that procedure while many of the unfavorable sequelae were undoubtedly due to the operation.

As regards the significance of the bacteria present he concludes: 1. The cases classed as due to saprophytes are mild and do not demand active local measures, especially those which might introduce virulent organisms. 2. Such cases are rare and differential diagnosis is most uncertain. The late complications: parametritis, thrombophlebitis, and general sepsis are more common in cases which have been curetted.

Digital curage or cleansing is usually considered as the most efficient and the least harmful, but the author believes that this procedure is more difficult and is accompanied by much trauma to the infected uterus and surrounding structures.

Direct application of antiseptics: alcohol, creosote in glycerine, iodoform, iodine, on gauze presents the same objections as does curettage and is not as efficient in removing debris. Experience with war wounds teaches that there are no antiseptics which kill bacteria on an infected surface without killing tissue cells, and that most of these agents destroy

the protective cells without killing all of the organisms.

Intra-uterine irrigations are the least dangerous but the most abused of all local measures. They have been advised by good authority, (Tarnier), on the first indication of fever or fetid lochia. However, there are many primary bad effects: reflex syncope, penetration of fluid through the tubes, gas emboli, perforation of the uterus, and usually an elevation of temperature. Good effects are uncertain and not greater than can be obtained by an ice-bag. Obviously it can accomplish little of value and presents many possibilities for extension of sepsis. He concludes. 1. In cases of postpartum infection, except where there is retention of placental fragments, it is dangerous and useless to invade the uterus, after the first week. 2. Digital curage, and local application of antiseptics should be absolutely discarded. 3. Intra-uterine irrigation with antiseptic solutions may be justified in case of retention of debris and clots if done early and not repeated. Most often it is useless. 4. Curettage as practiced by many men under similar conditions, is considered as useless and dangerous especially in cases of streptococcus infection.

ARCHIBALD L. McDONALD.

**HYSTERECTOMY IN THE LANKENAU (Formerly German Hospital):** John B. Deaver (Ann. of Surg., Jan., 1921.) This is an interesting presentation of the practice of the general surgeon, and comprises the work for 1919 as follows: 46 complete, and 84 sub-total hysterectomies, with two deaths. Complete hysterectomy was done for 7 uncomplicated fibroids, 14 complicated fibroids, and 10 prolapse of the uterus, the remainder being cancer of the cervix or fundus. There was one fatality due to myocarditis. This operation is preferred for patients near or past the menopause, or when there is doubt concerning the endometrium. The author uses a clamp on the vagina, which is then divided with a cautery and closed with sutures. In both the total and subtotal, the broad ligaments are fastened to the stump and the surface then well covered with peritoneum. Deaver has no hesitancy in making a transperitoneal hysterotomy for exploration or to remove submucous fibroids. For large low cervical tumors, he advises preliminary amputation of the fundus to simplify enucleation of the cervix and tumor. In complete hysterectomy the ureters are exposed back in the broad ligament so that they are in view while the vessels are ligated. He prefers hysterectomy to myomectomy for large intramural or submucous tumors.

During the same period radium was used for 58 cases as follows: Cancer cervix 39, cancer fundus 12, myomata 5, chronic endometritis 2. There was one fatality. He is much impressed with the destructive action of radium, purulent infiltration, gangrene or ulceration. The histology of such effects is described in some detail. There is no question

that radium will control bleeding and with the X-ray will reduce size of fibroids, but one must consider the effects of the absorption of necrotic tissue. Deaver has records of four deaths due to peritonitis, pelvic suppuration, and enterovaginal fistula following radium. For cancer of the fundus, and operable cancer of cervix the author prefers radical hysterectomy.

ARCHIBALD L. McDONALD.

## ROENTGENOLOGY

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**PAPAVERIN IN THE ROENTGEN DIAGNOSIS OF GASTRIC LESIONS:** Dr. Sigmund Szerb and Dr. Vidor Revesz, Budapest; (Forts. a. d. Geb. d. Roentgenstrahlen, Band XXVII, Heft 2.) The cases of delayed emptying time of the stomach which are met with in routine roentgen examination can be classified into two main groups on a basis of their morphology and motor peculiarities.

The first group consists of cases with weak musculature and an atonic stomach in which the peristaltic contraction is superficial and sluggish, and the emptying time is not complete within three or four hours, but requires from four to six hours or even eight to twelve hours.

In the second group belong cases with vigorous and rapid peristalsis, even more vigorous than is found in normal stomachs. In these cases, one is apt to find a more or less degree of dilatation. The delayed emptying time is due to either organic obstruction or to pylorospasm. Pylorospasm, in these cases, is not always due to a lesion of the stomach or the cap, but may be secondary to hyperacidity, hypersecretion, cholelithiasis, appendicitis and other extragastric pathology.

The use of papaverin in the differential diagnosis of pyloric stenosis and pylorospasm was first recommended by Holzknecht and Sgalitzer in 1913. Since the original publication, the authors have had the opportunity of using papaverin in two hundred and fifty cases. Of these, one hundred and seventy-six cases were thought, from a clinical standpoint, to represent pyloric stenosis. From a study of these cases, they come to the following conclusions: First, that if a delayed emptying time returns to normal after the administration of papaverin the possibility of an organic stenosis can be ruled out; second, if the delayed emptying time remains unchanged, or if, in the presence of vigorous peristalsis, it is increased, it is proof of the presence of an organic stenosis; third, if a slightly prolonged emptying time remains unchanged, one can conclude that a slight degree of stenosis and pylorospasm is present, but

should convince themselves of the correct diagnosis by repeated clinical and roentgen examinations.

They found the use of papaverin of no avail in the differential diagnosis of a spastic and organic hour-glass contraction of the stomach, nor in the differential diagnosis of spastic and organic contraction of the cardia. They recommend the use of papaverin as an antiemetic in cases which persistently vomit the contrast meal.

For diagnostic purposes, they use 0.08 papaverin hydrochloride (merk), one hour preceding the roentgen examination.

R. G. ALLISON.

**NEW ROENTGENOGRAPHIC TECHNIQUE FOR THE STUDY OF THE THYROID:** George E. Pfahler, (Am. Jr. Roent., Feb., 1921, p. 81.) The author devised this technique for the study of the thyroid in order to record the change in the size of the thyroid gland following roentgen therapy for hyperthyroidism. Incidentally it was found that it afforded an admirable method for showing the pressure on the trachea and oesophagus by posterior enlargements of the thyroid which were not determinable clinically.

The examination is made with the patient in the standing posture. The position best showing the outline of the tumor is obtained fluoroscopically. The patient's sternum and the anterior portion of the neck is pressed strongly against the fluoroscopic screen. The chin is turned toward the side on which the enlargement is most marked and tilted upward as far as possible. This draws the thyroid up into position where it can be shown on the plate. One's aim must be to get a good lateral view of the neck, but both shoulders should be as nearly as possible in contact with the plate. The tube plate distance is 25 inches. The tube is centered midway between the lower border of the jaw and the upper border of the clavicle and centered directly over the thyroid. The exposure will vary from 3-4 to 1 1-4 seconds, using duplitized films with double intensifying screens, depending upon the thickness of the patient's neck, with 35 milliamperes and a 5 inch gap.

R. G. ALLISON.

**GLYCOSURIA DURING PREGNANCY:** Roland S. Cron. (Amer. Jour. of Ob. and Gyn., Vol. 2, No. 3, Dec., 1920.) Under this caption the author presents one or more case histories of each of the following clinical conditions: Lactosuria, Alimentary Glycosuria, Renal Diabetes, Diabetes mellitus and Syphilis, and Diabetes Mellitus, all occurring during pregnancy.

After a discussion of each condition as a complication of pregnancy, the author offers the following summary and conclusions:

(1) A positive reaction with Fehling's solution during pregnancy does not necessarily indicate the existence of diabetes mellitus but is usually due to



a lactosuria or alimentary glycosuria and rarely to renal diabetes.

(2) Lactosuria is common during both pregnancy and the puerperium. It is entirely physiologic and must be differentiated from the various types of glycosuria.

(3) A large number, 30 to 50 per cent of pregnant women are less tolerant to glucose than non-pregnant individuals. They have no hyperglycemia and are not true diabetics.

(4) Glycosuria may be due to a lowering of the renal threshold for sugar. Albuminuria and glycosuria may accompany one another or alternate without hyperglycemia.

(5) Diabetes and albuminuria may accompany one another. This complication in pregnancy is an ominous one and calls for the immediate interruption of pregnancy.

(6) Diabetes and syphilis may complicate pregnancy. The treatment indicated is both dietary and antiluetic.

(7) Pregnancy may occur in diabetic women or diabetes may become manifest during pregnancy. Either is a serious complication. Many patients do perfectly well, but a considerable percentage die in coma or collapse or succumb to some intercurrent infection or die during successive pregnancies.

(8) The fetuses of diabetics, leaving out of consideration abortions and premature deliveries, are stillborn or die within a few days following birth in about 50 per cent of the cases.

(9) Fat is the most important factor in the production of acidosis. It should be reduced to a minimum or omitted entirely. Its only use is in bringing the caloric requirement of the patient up to normal.

(10) If sugar appears to a slight degree in pregnant women it should be carefully watched and controlled by diet and, unless a carbohydrate equilibrium can be maintained, pregnancy should be terminated. The advantage of Caesarean section under gas-oxygen should be kept in mind.

ALBERT G. SCHULZE.

## PEDIATRICS

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**CONCERNING DIRECT SMEARS IN DIPHTHERIA:** Adrien Bleyer, (*Am. Jour., Dis. of Child., Nov., 1920*): It is interesting to note how widely divergent have been the experiences of clinicians concerning the usefulness of direct smears in diphtheria. The inherent difficulty, it seems, lies in

the fact that grown on living tissues, the diphtheria bacillus appears in a great variety of forms, and that these stain indifferently and are, therefore, not so readily distinguishable as when obtained in culture. So in the present study we decided to ignore all of these types which were not overly familiar, and sought to determine some readily distinguishable form which would repeat itself sufficiently often to make search for it worth while.

The material from seventy cases of diphtheria were used. Specimens were secured from the membrane itself rather than from its surface because diphtheria bacilli are more often caught up in it than pushed up on it. Bits of membrane were detached with forceps and crushed between the cover slips in a hope of finding the germ. Of several stains tried Ponder's and Greenthal's seemed to serve better than others. Greenthal's stain is an acid stain in which the crystal violet is replaced by kresylecht violet; and a half minute usually suffices but it may be left on much longer.

**Recognition:** Diphtheria bacilli of the true type, suitably stained, are said to be distinguishable from all other organisms (Park), and are differentiated from pseudotypes by their length and form and the sharpness of staining of the granules. The body must be stained faintly, but seen distinctly and clearly from one end to the other through its entire length. By length alone one can often distinguish them from the common pseudo-bacillus of Hoffman which is usually shorter. In the entire series seventeen per cent were successful. This is not high but sufficiently so to make the test practicable and worth while.

In a small proportion of cases, a bacteriologic diagnosis of diphtheria can be made by direct smear as well as by culture. Contrary to the belief this is available to the clinician not possessed of unusual skill and affords a simple aid in the diagnosis.

ROY N. ANDREWS.

**THE ULCERATED MEATUS IN THE CIRCUMCISED CHILD:** Joseph Brennemann (*Amer. Jour. Dis. of Child., Jan., 1921.*). For a number of years the author's attention has been drawn with increasing frequency to a peculiar lesion of the meatus urinarius occurring only in circumcised male children, and characterized by ulceration, crusting, narrowing of the urinary passage, and nearly always accompanied by painful urination, distended bladder, and, occasionally, by hemorrhages. Routine examination of the urine gives no help. In twenty-five or more cases seen during the past winter and spring there has been no exception to the observation that this lesion is associated with what is known as the amoniactal diaper. The lesions manifests itself as rather a superficial ulceration about the meatus. It is probably preceded, by a vesicle, though this is rarely seen before it is broken. At times the ulceration becomes deep and extensive, up to 2 mm. in depth and 5 mm. in width, usually it is more or less

covered by a crust which is very firmly attached over a considerable area. There is more or less inflammation.

The symptomatology is evident from the pathology. The salty urine coming in contact with the denuded meatus causes acute pain when the child begins to urinate. He immediately stops urinating and cries with pain. No amount of coaxing will induce him to try it again until the distended bladder becomes intolerable or begins to overflow. Then, having once emptied the bladder the same cycle repeats itself at the next urination.

The ammoniacal diaper that apparently always causes this condition of the meatus is still surrounded with mystery in spite of its common occurrence. The odor is not simply one detectable on close effort but the fumes are like those that escape from a bottle of ammonia. This condition is rarely noticeable except at night and most often toward the morning. Again, it may be absent for weeks or months only to appear again. The general condition of the child is usually good.

It is much more common in the latter half of the first year; probably attains its maximum frequency and severity during the second year; becomes less common during the third year, and vanishes soon after this.

The failure of the ammonuria to occur, except in connection with the wet diaper in situ, together with the peculiar behavior of the ammoniacal diaper would suggest a nondietetic factor residing in the diaper itself. On this basis Zahorsky, after failure to combat the condition by lessening the fat in the

food and by the use of alkalies therapeutically, came to the conclusion that the "immediate cause of the ammoniacal diaper is the presence of an alkali in the diaper, or the bedding." Again, the same author points out that the diaper or bedding which is infected by an enormous amount of bacteria is not boiled daily, and that this alone would play an important part in the ammoniacal diaper. The more inviting theory is based on the work of Keller and others that in certain nutritional disturbances due to the ingestion of cow's milk fat beyond the infant's tolerance there is produced a relative acidosis of enteric origin which manifests itself in the wine in the excretions of a hypernormal amount of ammonium salts.

Treatment: The treatment is naturally directed to the lesion itself and to the prophylaxis and treatment of the diaper. If the meatus is ulcerated or crusted over to some extent, and there is no obstruction, the proper therapy would seem to consist in applying thickly some substance like petrolatum that would coat over the involved area so that urination may be less painful and so that there will be protection on contact with the diaper. When the meatus is acutely inflamed and the opening narrowed, a wet boric acid dressing has always relieved the condition. This should be kept moist and well padded with cotton before the diaper is put on. The relief from this procedure has almost been instantaneous. Dispensing of the diaper at night prevents new lesions and allows the old ones to heal. The diaper should be thoroughly rinsed and boiled daily as well as the night clothes and bedding.

R. N. ANDREWS.



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